



## ***SECTION 5***

### ***National Overview***



Photo on previous page: a sea turtle swims  
towards a pound net. Credit: NMFS NEFSC.

## SECTION 5.0 National Overview

### 5.1 Introduction

A total of 274 U.S. commercial fisheries are identified in the U.S. National Bycatch Report (Table 5.1). Of these, 152 are federally managed fisheries or fisheries with a relevant Federal data-collection component and form the basis of the analyses contained herein. These fisheries were evaluated for the quality of bycatch data-collection and estimation methods through a scoring system, and assigned to ranked tiers. Specific bycatch estimates were also provided by fishery and species where they were available. The remaining 122 fisheries identified in this report are managed by international, tribal, or state fishery management agencies. These fisheries were not evaluated through the tier scoring system and bycatch estimates were not calculated.

The bycatch information included in this report is very comprehensive and covers, either partially or entirely, a total of 11 LMEs.<sup>1</sup> These ecosystems and the fisheries they support vary among regions, with some fisheries crossing LME. Bycatch monitoring requirements are included in regional FMPs (Table 5.2), Take Reduction Plans (Table 5.3), and Biological Opinions (Table 5.3). The NMFS also collaborates with state fishery management agencies, interstate marine fisheries commissions, fishery management coun-



Credit: NMFS, SEFSC

A finetooth shark.

cils, and other organizations involved in bycatch monitoring and reduction activities. Several of the fisheries in this report are managed by international organizations, including ICCAT, IPHC, IATTC, and WCPMC.

<sup>1</sup> <http://www.lme.noaa.gov/>

**Table 5.1**  
U.S. commercial fisheries included in the U.S. National Bycatch Report, by NMFS region (data from the year 2005).

| Region          | Commercial fisheries | Fisheries under Federal management authority and/or with relevant Federal data collection | Fisheries under other management authority only <sup>a</sup> |
|-----------------|----------------------|---|--|
| Northeast       | 63                   | 52 <sup>b</sup>   | 11   |
| Southeast       | 48                   | 26  | 22   |
| Alaska          | 77                   | 35 <sup>c</sup>   | 42   |
| Northwest       | 30                   | 10 <sup>d</sup>   | 20   |
| Southwest       | 25                   | 11  | 14   |
| Pacific Islands | 31                   | 18  | 13   |
| Total           | 274                  | 152   | 122  |

<sup>a</sup> Other management authorities include state, international, and tribal fisheries organizations with no Federal data-collection component.

<sup>b</sup> Sixteen fisheries are grouped in the Northeast for purposes of protected species bycatch estimation.

<sup>c</sup> Five Alaska state fisheries are observed for protected resource interactions under the AMMOP. An additional six Alaska fisheries are grouped for purposes of protected species bycatch estimation.

<sup>d</sup> Two state fisheries with a Federal data-collection component (the Oregon pink shrimp and Oregon spot prawn fisheries) were not evaluated for this report.

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**Table 5.2**

Fishery management plans and the fishery management councils that supervise them, by NMFS region and ecosystem (LME). FMPs managed jointly are listed under the lead Council.

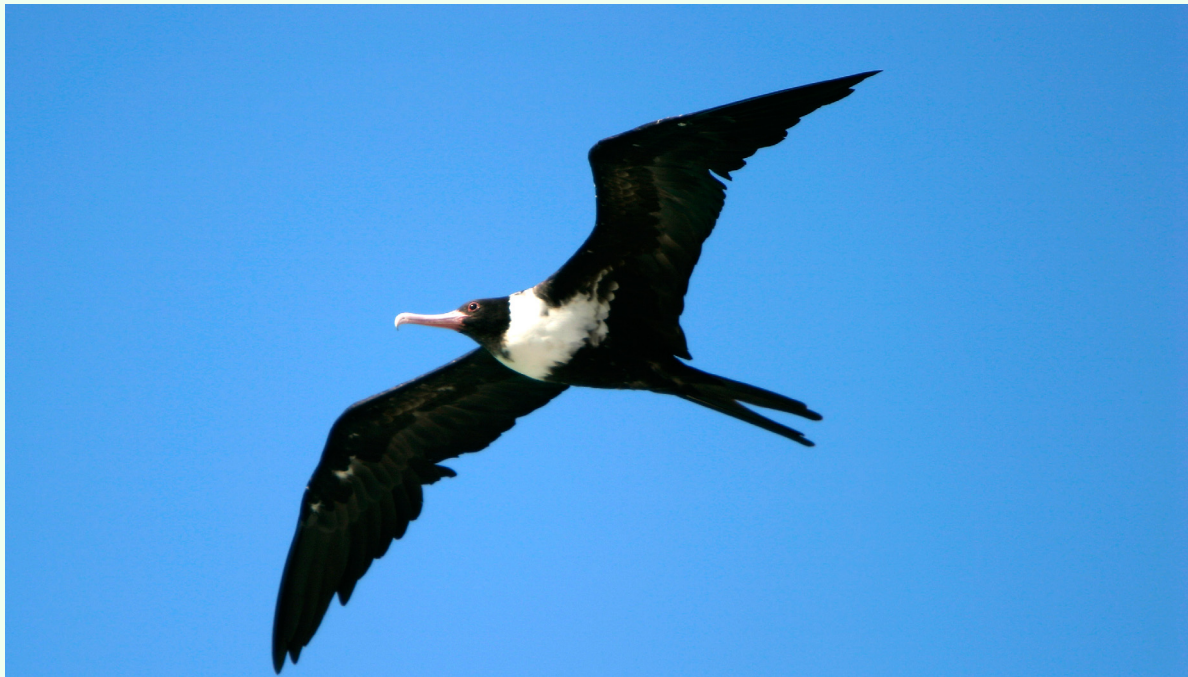
| Region    | Large marine ecosystem  | Fishery management council                                | Fishery management plans   |
|-----------|---|---|--|
| Northeast | Northeast U.S. Continental Shelf                                | New England Fishery Management Council                    | Atlantic Herring FMP   |
|           |   |   | Atlantic Sea Scallop FMP   |
|           |   |   | Deep Sea Red Crab FMP  |
|           |   |   | Northeast Multispecies FMP   |
|           |   |   | Northeast Skate Complex FMP  |
|           |   |   | Atlantic Salmon FMP  |
|           |   |   | Monkfish FMP   |
|           |   | Mid-Atlantic Fishery Management Council                   | Bluefish FMP   |
|           |   |   | Atlantic Mackerel, Squid, and Butterfish FMP                                       |
|           |   |   | Summer Flounder, Scup, and Black Sea Bass FMP                                      |
|           |   |   | Surfclam and Ocean Quahog FMP  |
| Southeast | Southeast U.S. Continental Shelf, Gulf of Mexico, and Caribbean |   | Tilefish FMP   |
|           |   |   | Spiny Dogfish FMP  |
|           |   | Mid-Atlantic Fishery Management Council                   | Regulations in several FMPs apply to North Carolina EEZ waters                     |
|           |   | South Atlantic Fishery Management Council                 | Atlantic Coast Red Drum FMP <sup>a</sup>   |
|           |   |   | Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic FMP   |
|           |   |   | Dolphin and Wahoo Fishery of the Atlantic FMP                                      |
|           |   |   | Golden Crab Fishery of the South Atlantic Region FMP                               |
|           |   |   | Shrimp Fishery of the South Atlantic Region FMP                                    |
|           |   |   | Snapper–Grouper Fishery of the South Atlantic Region FMP                           |
|           |   |   | Coral, Coral Reefs, and Live/Hard Bottom Habitats of the South Atlantic Region FMP |
|           |   |   | Pelagic Sargassum Habitat of the South Atlantic Region FMP                         |
|           |   | Gulf of Mexico Fishery Management Council                 | Reef Fish Resources of the Gulf of Mexico FMP                                      |
|           |   |   | Stone Crab Fishery of the Gulf of Mexico FMP                                       |
|           |   |   | Shrimp Fishery of the Gulf of Mexico FMP   |
|           |   |   | Red Drum Fishery of the Gulf of Mexico FMP   |
|           |   |   | Coral and Coral Reefs of the Gulf of Mexico FMP                                    |
|           |   | Joint South Atlantic and Gulf Fishery Management Councils | Coastal Migratory Pelagic Resources FMP  |
|           |   |   | Spiny Lobster in the Gulf of Mexico and South Atlantic FMP                         |
|           |   | Caribbean Fishery Management Council                      | Shallow Water Reef Fish Fishery FMP of Puerto Rico and the U.S. Virgin Islands     |
|           |   |   | Spiny Lobster Fishery FMP of Puerto Rico and the U.S. Virgin Islands               |
|           |   |   | Corals and Reef Associated Plants and Invertebrates FMP                            |
|           |   |   | Queen Conch Resources FMP of Puerto Rico and the U.S. Virgin Islands               |

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**Table 5.2** (continued)

| Region          | Large marine ecosystem  | Fishery management council                 | Fishery management plans   |
|-----------------|---|--|--|
| Alaska          | Aleutian Islands, Eastern Bering Sea, Western Bering Sea, Gulf of Alaska, Chukchi Sea, Beaufort Sea | North Pacific Fishery Management Council   | Groundfish of the Bering Sea and Aleutian Islands (BSAI) Management Area FMP   |
|                 |   |  | Groundfish of the Gulf of Alaska (GOA) FMP                                     |
|                 |   |  | BSAI King and Tanner Crab FMP  |
|                 |   |  | Scallop Fishery off Alaska FMP   |
|                 |   |  | Salmon FMP in the EEZ off the Coast of Alaska                                  |
| Northwest       | California Coastal Current  | Pacific Fishery Management Council         | Pacific Coast Groundfish FMP   |
| Southwest       |   |  | Pacific Coast Salmon FMP   |
|                 |   |  | Coastal Pelagics Species FMP   |
|                 |   |  | U.S. West Coast Fisheries for Highly Migratory Species FMP                     |
| Pacific Islands | Insular-Pacific Hawaiian  | Western Pacific Fishery Management Council | Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region FMP |
|                 |   |  | Crustacean Fisheries of the Western Pacific Region FMP                         |
|                 |   |  | Precious Coral Fisheries of the Western Pacific Region FMP                     |
|                 |   |  | WPFMC Coral Reef Ecosystem of the Western Pacific Region FMP                   |
|                 |   |  | Pelagic Fisheries of the Western Pacific Region FMP                            |

<sup>a</sup> Management of red drum was transferred to the ASMFC in 2008.



Credit: NOAA

A great frigate bird from the Hawaiian Islands.

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**Table 5.3**

Take Reduction Plans required under the MMPA and Biological Opinions required under the ESA, which may include mandatory and/or voluntary measures for reducing bycatch of marine mammals, sea turtles, and seabirds.

| Region    | Take reduction plans (TRPs)                                | Biological opinions (BiOps )   |
|-----------|--|--|
| Northeast | Harbor Porpoise TRP  | Authorization of Fisheries under the Federal Lobster Regulations (2001)  |
|           | Atlantic Large Whale TRP                                   | Federal Lobster Management in the EEZ for Implementation of Historic Participation (2002)  |
|           | Cetacean Bycatch in Trawl Fisheries (TRT convened in 2006) | Federal Atlantic Herring FMP   |
|           |  | Atlantic Sea Scallop FMP   |
|           |  | Atlantic Bluefish FMP  |
|           |  | Authorization of Fisheries under the Spiny Dogfish FMP   |
|           |  | Authorization of Fisheries under the Monkfish FMP  |
|           |  | Authorization of Fisheries under the Multispecies FMP  |
|           |  | Sea Turtle Conservation Measures for the Pound Net Fishery in Virginia Waters of the Chesapeake Bay                              |
|           |  | Implementation of the Deep-Sea Red Crab FMP  |
|           |  | Authorization of Fisheries under the Skate FMP   |
|           |  | FMP for the Atlantic Mackerel, Squid, and Atlantic Butterfish Fishery and Amendment 8 to the FMP                                 |
|           |  | Authorization of Fisheries under the Summer Flounder, Scup, and Black Sea Bass FMP   |
| Southeast |  | NMFS' Approval of the Tilefish FMP   |
|           | Bottlenose Dolphin TRP                                     | Atlantic Pelagic Longline BiOp 2004  |
|           | Pelagic Longline TRP                                       | Caribbean Fisheries BiOp   |
|           |  | Coastal Migratory Pelagics (Mackerel) fishery in the Gulf of Mexico and South Atlantic Regions — 2007 BiOp                       |
|           |  | Gulf of Mexico Reef Fish Fishery — 2005 BiOp <sup>a</sup>  |
|           |  | Gulf of Mexico and South Atlantic Spiny Lobster Fishery — 2009 BiOp  |
|           |  | Gulf of Mexico Shrimp Fishery and its Effects on Smalltooth Sawfish — 2006 BiOp  |
|           |  | Gulf of Mexico Stone Crab Fishery — 2009 BiOp  |
|           |  | Shrimp Fisheries of the Southeastern United States — 2002 BiOp   |
|           |  | South Atlantic FMP for Dolphin and Wahoo — 2003 BiOp   |
|           |  | South Atlantic Snapper-Grouper Fishery — 2006 BiOp   |
| Alaska    | None   | South Atlantic Shrimp Fishery and its Effects on Smalltooth Sawfish — 2005 BiOp  |
|           |  | Southeastern Atlantic and Gulf of Mexico Shark Bottom Longline / Large Coastal and Coastal Shark Aggregate Fisheries — 2008 BiOp |
|           |  | Groundfish of the Bering Sea and Aleutian Islands (BSAI) Management Area FMP   |
|           |  | Groundfish of the Gulf of Alaska (GOA) FMP BiOp (Seabirds)   |

Table 5.3 (continued)

| Region          | Take reduction plans (TRPs)   | Biological opinions (BiOps )   |
|-----------------|-------------------------------|--|
| Northwest       | None                          | None currently in place  |
| Southwest       | Pacific Offshore Cetacean TRP | None currently in place  |
| Pacific Islands | None                          | Bottomfish Fishery BiOp  |
|                 |                               | Deep-Set Tuna and Shallow-Set Swordfish Fishery BiOps (one per fishery for sea turtles and marine mammals) |
|                 |                               | USFW BiOp for short-tailed albatross   |

<sup>a</sup> The 2005 Reef Fish Biological Opinion was superseded by a new Biological Opinion in 2009.

## 5.2 Bycatch Data-Collection Sources and Estimation Methods

Monitoring of bycatch is an essential component of effective management of fisheries. The data sources identified in this report vary among regions as well as among fisheries primarily due to differences in data-collection program goals, objectives, and priorities, but the differing data sources are also related to the diversity of U.S. commercial fisheries and variation in fishing practices. Multiple data sources were available for some of these fisheries. The primary data sources used to calculate estimates of bycatch were observer data (110 fisheries) and self-reported logbooks (80 fisheries; Table 5.4). Total landings by fishery were provided by each NMFS region for consistency with other published reports. However, aggregate landings at the species level were obtained from the NMFS centralized landings database.<sup>2</sup>

Observer programs are conducted in all six NMFS regions, and observer data were available for 110 U.S. commercial fisheries (72% of the 152 fisheries in this report). Coverage levels vary among fisheries due to factors such as program objectives, availability of funds, fishery characteristics, and uncontrollable factors such as weather conditions and unsafe vessels (e.g. vessels that have safety decal, but are determined to be unsafe for operational purposes). While specifics on individual observer programs are described in the regional sections of Section 4, the data collected by all regional observer programs were the main source of information used to estimate bycatch in this report.

Logbook data were used in bycatch estimation for 80 of the U.S. commercial fisheries discussed in this report. Logbook data were used to estimate bycatch in the absence of observer data, or were used as supplemental data. Since logbook data are self-reported, external verification is necessary to validate the information. This typically involves

comparison of self-reported bycatch data to bycatch data directly observed in an observer program, and is possible only if an observer program has been implemented for the same fishery. In the absence of verification, logbook under-reporting is a potential source of bias and error when estimating bycatch.

Other supplemental data were provided through dealer and landings reports, production reports, and stranding/entanglement data. The data provided by these programs were not used to calculate bycatch alone, but were used as ancillary information in developing extrapolation factors to estimate overall bycatch when data from only partial (less than 100%) observer coverage were available. Data collected through dealer or landing reports were available for 61 fisheries included in this report. Data collected through production reports were available for 25 Alaskan fisheries. Stranding and entanglement data recorded under the MMPA were used to assess relative levels of bycatch only when more reliable data sources were not available, a report was considered reliable, and the report clearly described a mortality or serious injury that was likely to lead to mortality of the entangled animal. These data sources were used to generate bycatch estimates for some protected resources reported (e.g., in the Alaska and Northeast regions).

As might be expected, bycatch estimation approaches varied widely among regions and, in many instances, within regions, where fishery-specific differences in data availability and data quality occur. However, all regional estimation methods were evaluated during an internal NMFS workshop and found to be appropriate for estimating bycatch. Readers are encouraged to review comprehensive information on regional bycatch estimation methods presented in Section 4. Further work is needed to develop best practice approaches to bycatch estimation; this can be addressed through national workshops or external peer review processes.

<sup>2</sup> <http://www.st.nmfs.noaa.gov/st1/commercial/index.html>



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**Table 5.4**

Data sources used to develop 2005 estimates, by region and fishery. A blank means the data source was not used in developing bycatch estimates, not that the data source does not exist in the region.

| Region /<br># fisheries <sup>a</sup> | Fisheries<br>observed <sup>b</sup> | Observed days<br>at sea <sup>c</sup> | Fisheries with<br>production reports<br>/dealer reports <sup>d</sup> | Fisheries with<br>logbooks /<br>vessel trip reports /<br>catch reports/ trip<br>tickets <sup>e</sup> | Fisheries with<br>production reports |
|--------------------------------------|------------------------------------|--------------------------------------|--|--|--------------------------------------|
| Northeast / 63                       | 47                                 | 11,381                               | 27   | 42   |                                      |
| Southeast / 48                       | 12                                 | 2,657                                |  | 9  |                                      |
| Alaska / 77                          | 27                                 | 35,683                               | 27   |  | 25                                   |
| Northwest / 30                       | 11                                 | 6,184                                |  | 9  |                                      |
| Southwest / 25                       | 10 <sup>f</sup>                    | 499                                  |  | 10   |                                      |
| Pacific Islands / 31                 | 3                                  | 7,099                                | 7  | 10   |                                      |
| Total / 274                          | 110                                | 67,030                               | 61   | 80   | 25                                   |

<sup>a</sup> Numbers of U.S. commercial fisheries included in the U.S. National Bycatch Report.

<sup>b</sup> Maximum number of fisheries observed, 2005 to present.

<sup>c</sup> Numbers of observed sea days are for calendar year 2005; totals for days at sea only, does not include observations of 663 permit samples.

<sup>d</sup> Production and Dealer (landing) reports are submitted by either dealers or processors upon landing of catch.

<sup>e</sup> Logbooks, vessel trip reports, catch reports, and fish tickets are all names for similar reports submitted by fishermen.

<sup>f</sup> One fishery listed as observed for the Southwest Region is a recreational fishery, and bycatch estimates are not included in the U.S. National Bycatch Report for this fishery.

## 5.3 Evaluation of Bycatch Data and Bycatch Estimation Methods

A standardized set of criteria was used to evaluate data quality and bycatch estimation methods for the subset of 152 fisheries included in this report. Tier scores were assigned to each fishery using the tier scoring procedures outlined in Section 3 for fish, marine mammals, and other protected species. Fisheries with lower overall scores were assigned to a low tier (e.g., Tier 0, Tier 1) and fisheries with a high overall score were assigned to higher tiers (Tier 3, Tier 4). It is important to note that tier scores are based on 2005 information and many fisheries may have made improvements since then.

### Tier Descriptions:

- For Tier 4 fisheries, bycatch estimates were available and were based on the highest-quality data and analytical methods.
- For Tier 3 fisheries, bycatch estimates were also generally available but higher quality data (i.e., data that are more reliable, accurate, and/or precise than those used in lower tiers) were utilized to compute these estimates.
- For Tier 2 fisheries, bycatch estimates were generally available. However, these estimates would have benefited from improvements in data quality and/or analytical methods (such as improved sampling designs, increased coverage levels, and peer review of methods). Where bycatch estimates were not available, methods are being developed.
- For Tier 1 fisheries, bycatch data were available but were generally unreliable (e.g., from unverified or potentially biased sources). In some cases, higher quality data were available but analytical methods had not been implemented.
- For Tier 0 fisheries, bycatch data-collection programs or estimation methods did not exist and, therefore, bycatch estimates were not available.



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Estimates for all three types of bycatch (fish, marine mammals, and other protected species) were not available for all fisheries; therefore, the total number of fisheries evaluated varied by bycatch type. In addition, the total numbers of fisheries shown as evaluated for fish and for protected species differ due to the grouping of some fisheries. Further, only protected species data are collected in some fisheries, for example those observed by the AMMOP. A total of 142 fisheries were evaluated for fish bycatch data quality and estimation, while 129 were evaluated for data quality and estimation of marine mammal bycatch, with the same number evaluated for other protected species.

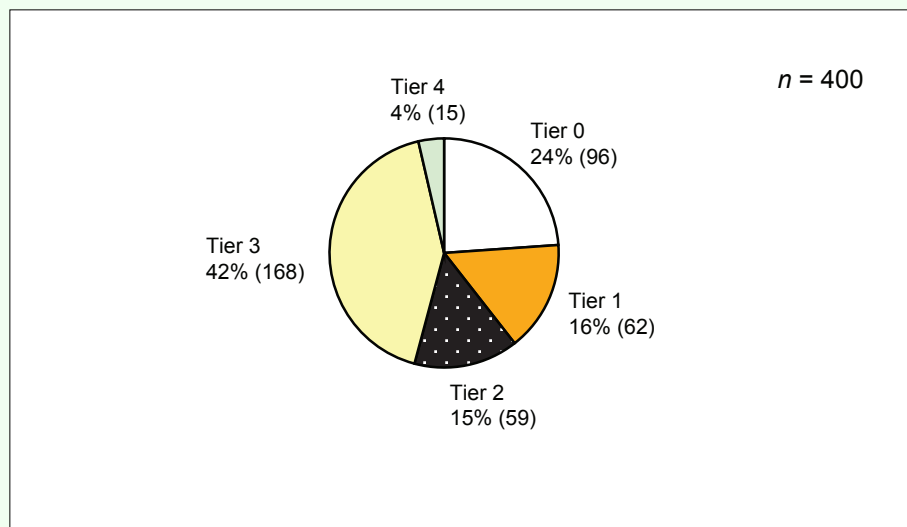
The majority of fisheries (42% of the 400 tier classifications assigned) were classified in Tier 3, while 15% fell into Tier 2, and 16% into Tier 1. Only 4% were classified in Tier 4. Bycatch data-collection programs and/or estimation methods did not exist for 24% of the fisheries evaluated and these were therefore classified as Tier 0 (Figure 5.1).

Results of the tier classification reveal some variation among the quality of data and estimation methods for different bycatch types (Figure 5.2). For fish bycatch, only 13% of the fisheries were classified in Tier 0, while 41% were classified in Tiers 1 and 2, and 46% in Tiers 3 and 4. For

marine mammals and other protected species, 30% of the fisheries were classified in Tier 0, while approximately 25% were classified in Tiers 1 and 2, and 45% in Tiers 3 and 4. This suggests that there is less data collection specifically targeted to bycatch of marine mammals and other protected species than to bycatch of fish (more than double the percentage of fisheries were Tier 0 for marine mammals and other protected species). However, of the fisheries where data were available (i.e., around 45% of fisheries in Tiers 3 and 4), the quality of the bycatch data and estimates was similar for fish species and for marine mammals and other protected resources.

The tier scoring system can be used as a national performance measure to monitor changes in the quality of bycatch data collection and estimation. It also provides a measure of the relative quality of bycatch estimates within and between regions, bycatch categories, stocks, and fisheries. As improvements are made to bycatch data collection, and new methods for estimating bycatch are developed and implemented, the tier scores of individual fisheries are also expected to increase.

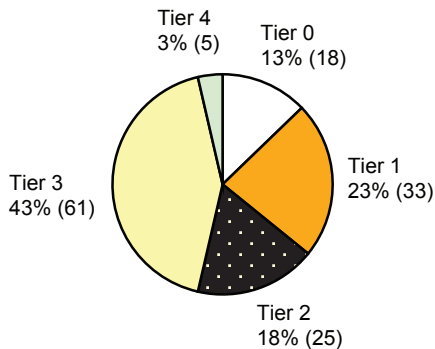
This first edition of the U.S. National Bycatch Report includes bycatch estimates for federally managed commer-



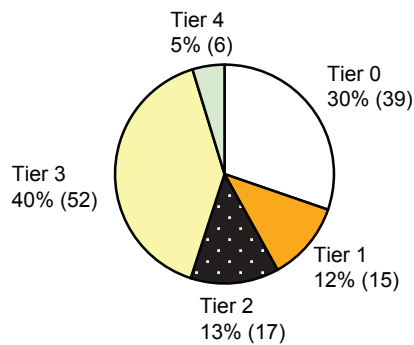
**Figure 5.1**  
Distribution of the 400 separate tier scores assigned to fisheries for the year 2005 for fish (142), marine mammal (129), and other protected species (129) bycatch.

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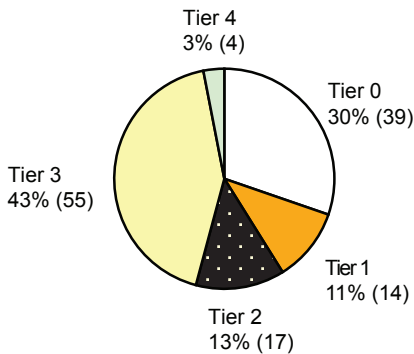
## A. Fish n = 142



## B. Marine Mammals n = 129



## C. Other Protected Species n = 129



**Figure 5.2**

Distribution of tier scores assigned to fisheries for the year 2005 for bycatch of A) fish, B) marine mammals, and C) other protected species.

cial fisheries and fisheries with a relevant Federal data-collection component. Bycatch data are also available for some state, tribal, and international commercial fisheries. In future editions of this report, the tier classification system should be applied to additional commercial fisheries. In addition, because some stocks have higher bycatch mortality attributable to recreational fisheries than to commercial fisheries, consideration should be given to including recreational fisheries. Coordination will be required with state, tribal, and international organizations to ensure accuracy and consistency in this information.

## 5.4 Identification of Key Stocks

Key stocks were identified based on the level of bycatch, management importance, and stock status. A total of 396 key stocks were so identified nationwide. Of the 396 key stocks, the majority (68%) were fish stocks. Forty-six percent of key fish stocks were FSSI stocks, which reflects the importance of these stocks to management. All ESA-listed stocks were classified as key stocks, including all sea turtle populations. Stocks occurring in multiple regions were listed as key in every region where bycatch was a concern.

The total number of key stocks varied by region, with the Southwest Region identifying the highest number, 121 stocks (31% of the national total). The high number of key stocks identified in the Southwest Region was mainly due to the lack of bycatch estimates for fish species. Because no fish bycatch estimates were available in the region, all stocks of management importance were placed on list of key stocks as a precautionary measure. Bycatch estimation methods are currently being developed for this region and estimates will be included in future editions of this report.

The list of key stocks, which includes a significant number of stocks from each region and bycatch type, will be used as a performance measure to monitor bycatch trends over time. Bycatch estimation methods are currently being developed in some regions to expand the regions' ability to calculate bycatch estimates for key stocks. As these bycatch estimates become available they should be included in future editions of the report, which will allow for the evaluation of trends in bycatch for more key stocks.



Credit: NMFS NWFSC

Catch of Pacific hake.

## 5.5 Fishery Bycatch

Bycatch estimates were not available for all commercial fisheries included in this report, even though data may exist. Fishery bycatch ratios (bycatch ratio = bycatch / (bycatch + landings)) were calculated for each fishery where fish bycatch estimates and total fish catch data were available. These ratios can be used as relative measures of the total bycatch occurring in each fishery. Fishery bycatch ratios could be calculated for only a subset of the fisheries where bycatch estimates were calculated (63 fisheries, or 41.5%). For the remaining 7 fisheries, it was not possible to calculate fishery bycatch ratios for various reasons. For example, in some Southeast Region fisheries, fish bycatch estimates were available only in numbers, but total catch was reported by weight.

Bycatch estimation methods are currently being developed in some regions to allow calculation of bycatch estimates for additional fisheries. As additional bycatch estimates become available they should be included in future editions of this report to provide a more comprehensive and accurate estimate of total bycatch mortality.

Fishery bycatch ratios ranged from zero to 0.76, and varied by region (Figure 5.3 – 5.7). Fishery bycatch estimates, and therefore bycatch ratios, were not calculated for Southwest Region fisheries since fish bycatch estimation methods were not available during the time when this report was developed. The Pacific Islands Region calculated fish bycatch estimates for only two fisheries.

Fisheries with a bycatch ratio of greater than 0.17 were classified as “fisheries of focus,” indicating a potential bycatch concern (Figure 5.3–5.7).<sup>3</sup> Fisheries with potential bycatch concerns were also evaluated through a qualitative process, as described in Section 3. In general, the fisheries with the highest bycatch ratios were trawl and bottom longline fisheries

<sup>3</sup> The process of selecting this cutoff is described in Section 3. This number represents the median of available fishery bycatch ratios.



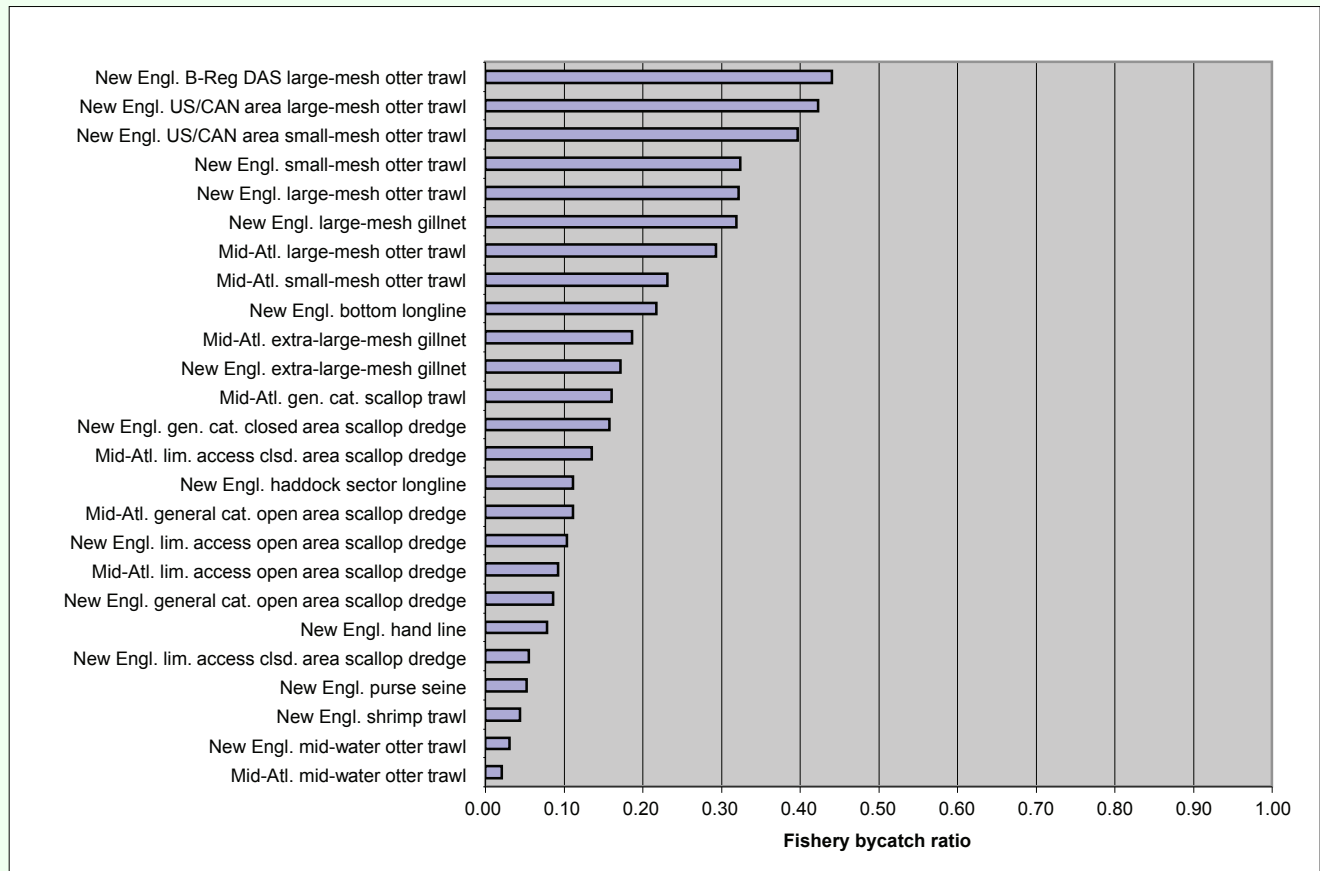
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## 5.5.1 Northeast Region Fishery Bycatch

Bycatch estimates were provided for 25 Northeast Region commercial fisheries, ranging from 51,000 lb in the New England handline fishery to over 20 M lb in the New England and Mid-Atlantic otter trawl fisheries. Bycatch ratios ranged from 0.02 to 0.44; they were lowest in the New England and Mid-Atlantic mid-water otter trawl fisheries (0.02 and 0.03, respectively; Figure 5.3), even though the fish bycatch weight estimates for these fisheries are 1.7 and 4.1 M lb, respectively. Bycatch ratios were also low for the New England shrimp trawl (0.04), the New England purse seine (0.05), the New England handline (0.08), and the New England haddock sector longline (0.11) fisheries.

Bycatch levels and ratios for the scallop dredge fisheries were variable but generally below 0.17. Bycatch levels for the three regional gillnet fisheries range between 1.4 M and 4.7 M lb, with bycatch ratios of 0.17 to 0.32. The highest levels of bycatch were in the New England and Mid-Atlantic otter trawl fisheries (small- and large-mesh). Bycatch estimates for these four fisheries ranged from 11.8 to 20.9 M lb, with bycatch ratios between 0.23 and 0.32.

In addition to the above-mentioned fisheries, two fisheries in this region were associated with special-access programs (SAPs) during the time period the data were collected: the New England U.S./Canada Management Area large-mesh otter trawl fishery, and the New England B-day DAS large-



**Figure 5.3**  
Fishery bycatch ratios for Northeast Region fisheries (2005 data).

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mesh otter trawl fishery. The number of days vessels could use to harvest groundfish under the New England Fisheries Management Council's Northeast Multispecies FMP was limited; in 2005, about 60% of the days were used at the owner's discretion under the FMP. These were called "A days." The remaining 40%, called B days, were evenly divided between two "B" categories: B Regular and B Reserve days-at-sea. These could only be used to target the six groundfish stocks that could sustain additional effort, in ways that did not undermine longer-term rebuilding efforts for other stocks in the fishery. Bycatch ratios for these fisheries were relatively high (0.40 to 0.44). Due to the difficulties of identifying trips participating in these fisheries, total bycatch, total landings, and the resultant bycatch ratios should be viewed with caution. Readers are encouraged to refer to Wigley et al. (2008) for further information.



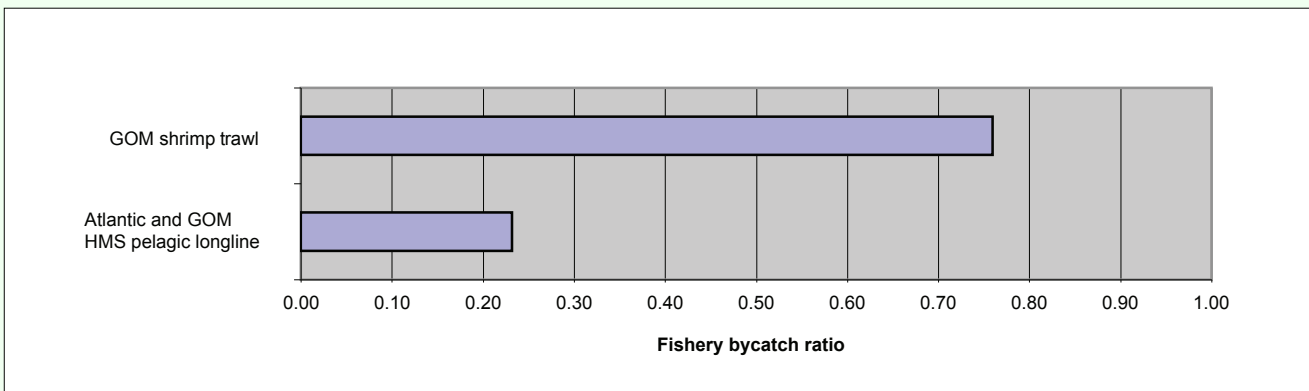
Credit: NMFS SWFSC, Brandi Noble Collection.

Gag grouper.

### 5.5.2 Southeast Region Fishery Bycatch

Fish bycatch estimates were provided for nine Southeast Region commercial fisheries. However, the Gulf of Mexico shrimp trawl fishery and the Southeastern Atlantic and Gulf of Mexico HMS pelagic longline fishery were the only two fisheries for which both bycatch and landings information were available in weight. Therefore, bycatch ratios were calculated for only these two fisheries (Figure 5.4). The by-

catch estimate for the HMS pelagic longline fishery was 1.7 M lb and landings were about 5.6 M lb, resulting in a bycatch ratio of 0.23. Bycatch was estimated for the offshore portion of the Gulf of Mexico shrimp fishery at 681 M lbs. Landings for the Gulf of Mexico shrimp trawl fishery were 213 M lbs. The resulting bycatch ratio for the fishery is 0.76.



**Figure 5.4**

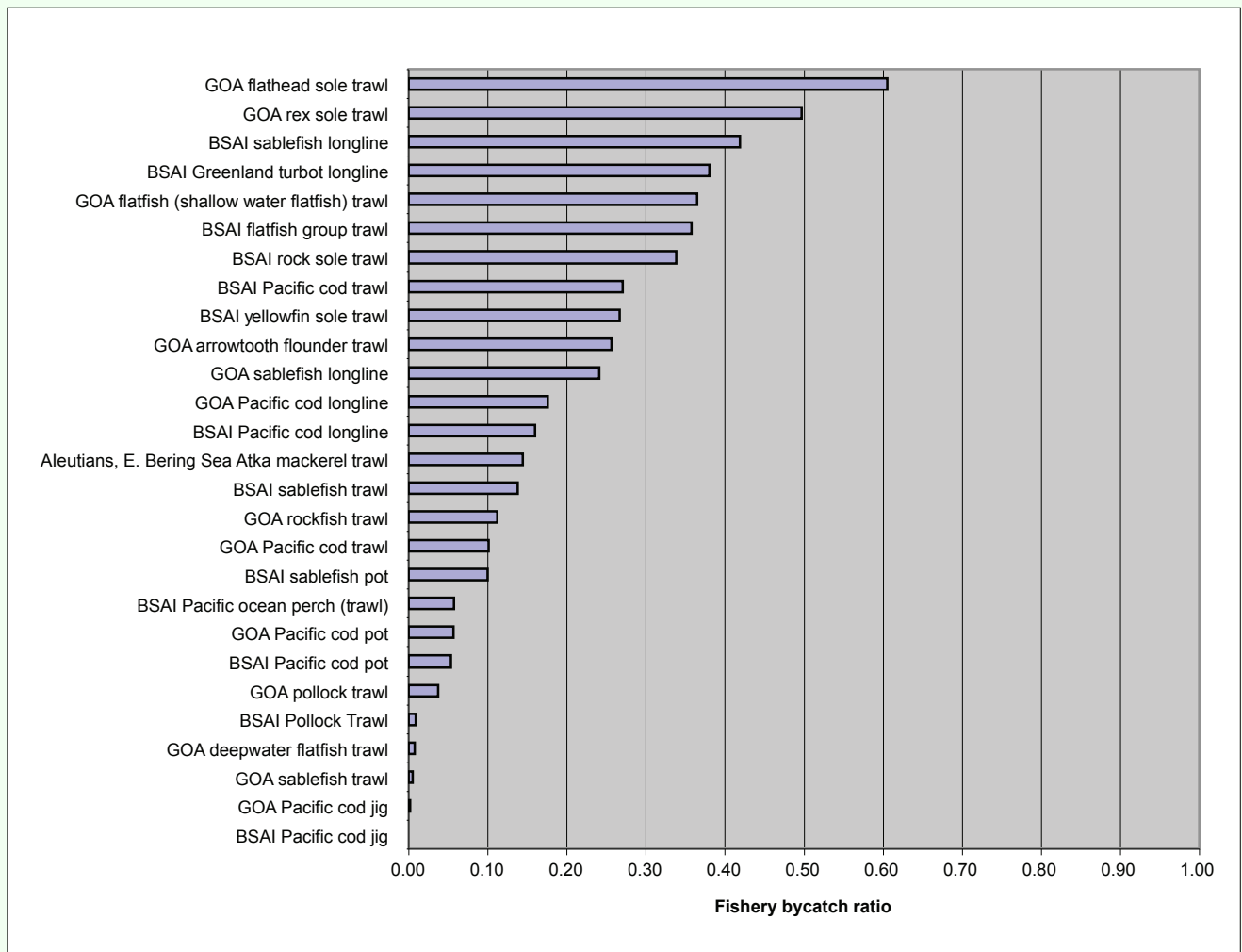
Fishery bycatch ratios for Southeast Region fisheries (2005 data). Bycatch ratios were not possible for many Southeast Region fisheries where landings were in pounds but bycatch was estimated in number of individuals. GOM = Gulf of Mexico.

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## 5.5.3 Alaska Region Fishery Bycatch

Bycatch estimates were provided for 27 Alaska Region commercial fisheries (Figure 5.5). Fourteen of these fisheries were BSAI fisheries and 13 occurred in the GOA. The principal BSAI fisheries were prosecuted with pelagic and non-pelagic (demersal) trawl longline and with pots, with one small jig fishery. Fish bycatch estimates and overall landings were very low for the jig fishery (BSAI Pacific cod), with catch estimated at 375 K lb (bycatch ratio of zero). For the remaining BSAI fisheries, bycatch ratios ranged between 0.01 and 0.57. The lowest bycatch ratio was documented for the BSAI pelagic trawl fishery for walleye pollock (0.01). This is a very large fishery, with landings in excess of 3.2 B lb and an estimated bycatch of 27 M lb. Bycatch ratios for

the two BSAI pot fisheries (sablefish and Pacific cod) were relatively low: 0.10 and 0.05, respectively, with total bycatch estimates of 232 K lb and 2.3 M lb, respectively. The Atka mackerel trawl fishery bycatch ratio was also relatively low: 0.16, representing a bycatch estimate of 18.5 M lb. Longline and non-pelagic (or demersal) trawl fisheries generally produced larger bycatch ratio estimates (0.14–0.42). The BSAI longline fisheries for Greenland turbot, Pacific cod, and sablefish produced bycatch ratios of 0.38 (2.3 M lb bycatch), 0.16 (50.9 M lb. bycatch), and 0.42 (1.33 M lb bycatch), respectively. Several non-pelagic trawl fisheries produced bycatch ratios greater than 0.25, including several flatfish fisheries with bycatch estimates of 25–68 M lb, and a Pacific cod fishery with a bycatch estimate 54 M lb.



**Figure 5.5**  
Fishery bycatch ratios for Alaska Region fisheries (2005 data). Note that the Bering Sea/Aleutian Islands flatfish group (arrowtooth flounder, flathead sole, and other flatfish) trawl fishery has been abbreviated as “BSAI flatfish group trawl.”



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Trends in bycatch ratios for the GOA were similar to those observed in the BSAI, although the total volume of fish landed was generally much lower. The bycatch ratio for the GOA Pacific cod jig fishery was less than 0.001, representing less than 1,000 lb of bycatch for cod landings in excess of 7 M lb. The GOA Pacific cod fishery bycatch ratio was 0.06, equivalent to a bycatch estimate of 3.0 M lb for total cod landings of 52 M lb. Longline fishery bycatch ratios were 0.18 and 0.24 for the Pacific cod (bycatch estimate 4.7 M lb) and sablefish (bycatch estimate of 10 M lb) fisheries, respectively. The estimated bycatch ratio for the GOA pelagic trawl fishery was 0.04, with estimated bycatch of 5.5 M lb for pollock landings of 143.7M lb. For the non-pelagic trawl fisheries, bycatch ratios ranged between <0.001 for the very low-volume sablefish trawl fishery, to 0.50 and 0.60 for the rex sole (estimated bycatch 4.5M lb) and flathead sole (estimated bycatch 4.2 M lb) fisheries, respectively.

Catch and bycatch of managed fish and invertebrate stocks in Alaska are generally accounted for in the stock assessment and in-season management processes. That is, fishing mortality estimates are calculated by summing estimates of retained and discarded weights. Low levels of bycatch mortality of sensitive or key species may be of greater concern than high bycatch levels for populations that are abundant and for which allowable catch levels are also high. Discard mortality is assumed to be 100% for all species except Pacific halibut.

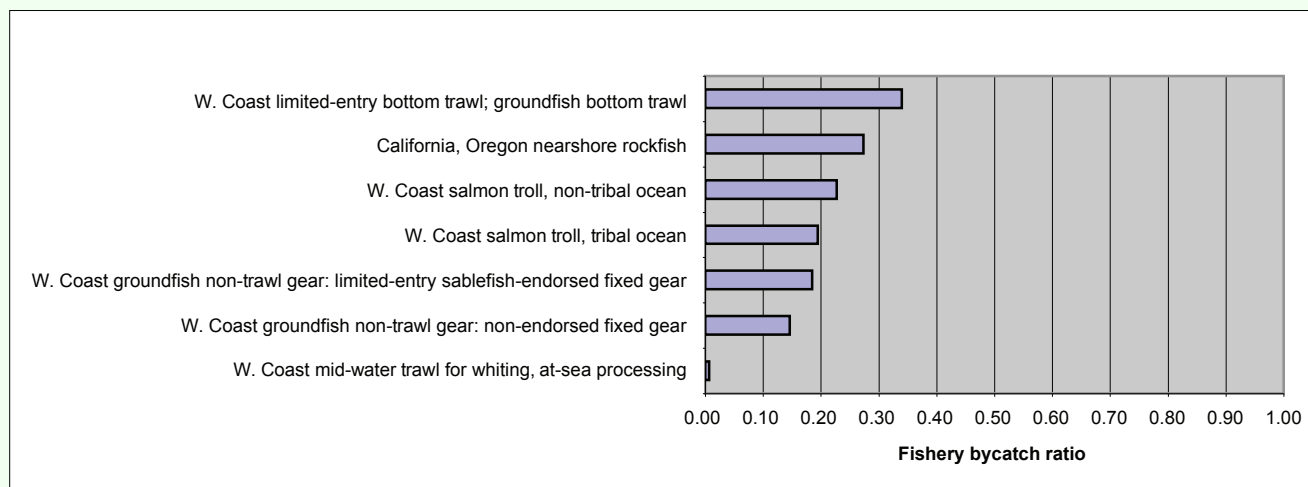
### 5.5.4 Northwest Region Fishery Bycatch

Fishery bycatch estimates were provided for seven Northwest Region commercial fisheries. Trawl (pelagic and non-pelagic), demersal longline, pots, troll, and other hook-and-line gear (fishing poles) were used to prosecute these fisheries. Computed fishery bycatch ratios for Northwest commercial fisheries ranged from 0.01 to 0.34 (Figure 5.6).

The lowest overall fishery bycatch ratios occurred in the West Coast mid-water hake trawl (at-sea processing) fishery and the West Coast groundfish non-trawl gear (non-endorsed fixed gear) fishery. The West Coast mid-water hake trawl (at-sea processing) fishery is a very large-volume fishery, with total retained weight of approximately 280 M lb and a bycatch estimate of 1.6 M lb, resulting in a low fishery bycatch ratio (0.01). Bycatch in the West Coast groundfish non-trawl gear (non-endorsed fixed gear) fishery was estimated to be approximately 600 K lb, with a fishery bycatch ratio of 0.15.

Bycatch estimates in the West Coast tribal and non-tribal ocean salmon troll fisheries were 15.8 K and 184.6 K fish, respectively, with fishery bycatch ratios of 0.19 and 0.23, respectively (note that both catch and bycatch are reported in numbers of individuals for these fisheries). The California/Oregon nearshore rockfish fishery bycatch estimate was 336 K lb, with a fishery bycatch ratio of 0.27.

The West Coast limited-entry bottom trawl (groundfish bottom trawl) fishery bycatch estimate was over 21 M lb, with a fishery bycatch ratio of 0.34. Bycatch of target species comprised a substantial proportion of overall bycatch in this fishery. Target species were discarded for a variety of reasons including economic market factors, size, and regulations.



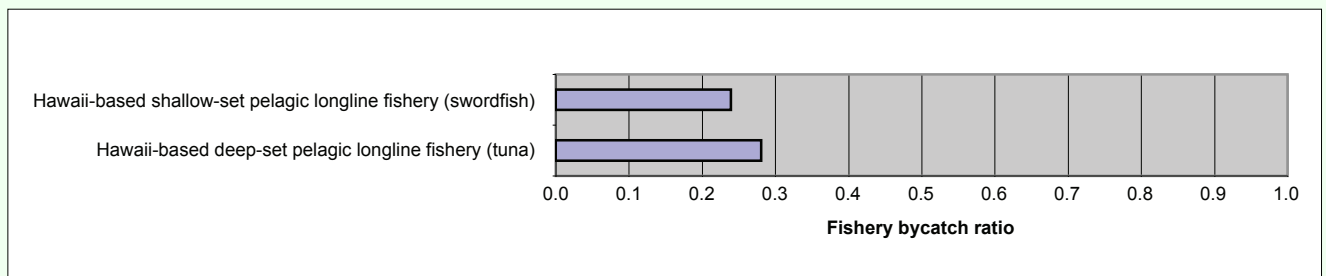
**Figure 5.6**  
Fishery bycatch ratios for Northwest Region fisheries (2005 data).

## 5.5.5 Pacific Islands Region Fishery Bycatch

Bycatch estimates were provided for two Pacific Islands Region commercial fisheries: the Hawaii-based shallow-set pelagic longline fishery (swordfish) and the Hawaii-based deep-set pelagic longline fishery (tuna). Overall fishery bycatch estimates for these two fisheries were 1.1 M lb and 7.4 M lb, respectively, with fishery bycatch ratios of 0.24 for the shallow-set and 0.28 for the deep-set fishery (Figure 5.7).

## 5.6 Bycatch by Resource Type

Estimates were calculated for bycatch of fish, marine mammals, sea turtles, and seabirds where supporting data were available. Bycatch was estimated for a total of 480 fish species, 54 marine mammal stocks, all U.S. sea turtle populations, and 28 seabird populations (Table 5.5). Stocks were counted more than once if estimates were produced in more than one region.



**Figure 5.7**  
Fishery bycatch ratios for Pacific Islands Region fisheries (2005 data).



Credit: Adam Li, NMFS

Pilot whale.

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**Table 5.5**

Bycatch estimates by region and resource type. Note that a single species or population may occur in multiple regions and that estimates for unidentified animals are included. Estimates in this report employed data from 2005; however, for some rare-event species multiple years of data were used to calculate estimates.

| Region   | Fish stocks with bycatch estimates | Marine mammal stocks with bycatch estimates | Sea turtle populations with bycatch estimates <sup>a</sup> | Seabird populations with bycatch estimates |
|--|------------------------------------|---|--|--|
| Northeast  | 34                                 | 6   | 1 <sup>b</sup>   | NA <sup>c</sup>                            |
| Southeast  | 215                                | 5   | 6  | 5  |
| Alaska   | 91                                 | 17  | NA <sup>d</sup>  | 12   |
| Northwest  | 52                                 | 3   | NA <sup>e</sup>  | 7  |
| Southwest  | 0 <sup>f</sup>                     | 8   | 1  | 0 <sup>f</sup>                             |
| Pacific Islands                                    | 88                                 | 15  | 4  | 4  |
| Total number of bycatch estimates by resource type | 480                                | 54  | 12   | 28   |

<sup>a</sup> Six sea turtle populations are found in the U.S. Note that some regions provided estimates for unidentified sea turtles in addition to those for specific populations.

<sup>b</sup> The Northeast Region provided bycatch estimates of zero for all sea turtle species that occur in the region, except for the loggerhead sea turtle.

<sup>c</sup> The Northeast Region is currently developing seabird bycatch estimation methods.

<sup>d</sup> Sea turtles occur rarely in the Alaska Region, and no sea turtle bycatch has been observed.

<sup>e</sup> No sea turtle bycatch was observed in the Northwest Region (bycatch was reported as 0 for all sea turtle populations for all fisheries). However, it was not possible to determine the number of populations that would be included in the zero estimates; therefore a number is not listed in this table.

<sup>f</sup> The Southwest Region is currently developing fish bycatch estimation methods.

### 5.6.1 Fish Bycatch

This report provides bycatch estimates for 480 fish stocks. Bycatch ratios were calculated for each stock where bycatch estimates and total fish catch data were available. Stock bycatch ratios were developed to measure the relative amount of bycatch to total catch for each fish stock, although both the amount of bycatch and the bycatch ratio are important when examining the impact of bycatch.

The number of fish stocks for which bycatch estimates were made varied by region. The Southeast Region provided the highest number (206) due to the large diversity in South Atlantic, Gulf of Mexico, and Caribbean fisheries. The Southwest Region did not provide bycatch estimates for fish stocks.

Stock bycatch ratios could be calculated for only the small subset of fish where bycatch estimates were calculated (93 fish stocks; 19.4%), for two principal reasons. First, fish bycatch estimates were calculated in numbers of fish in

several fisheries, while landings were generally provided in weight. Since factors to convert the numeric estimates into weight were not always available, it was not always possible to calculate bycatch ratios for these stocks. Second, many of the landings statistics contained in the national database were provided for groups of fish species, while bycatch estimates were calculated at the species or stock level. Since no method was available to determine individual species catch for grouped species, it was not possible to calculate stock bycatch ratios. Database improvements are needed to allow development of stock bycatch ratios in future editions of this report.

Stock bycatch ratios ranged from 0.01 to 1.0 (Figure 5.8–5.12). It is difficult to compare species bycatch estimates among regions due to the large number of species included in this report and differences in the quantity and quality of data among regions. When a fish stock had a bycatch ratio of greater than 0.127 and other considerations were met, it was classified as a key stock (refer to Section 3 for a complete description of the criteria).

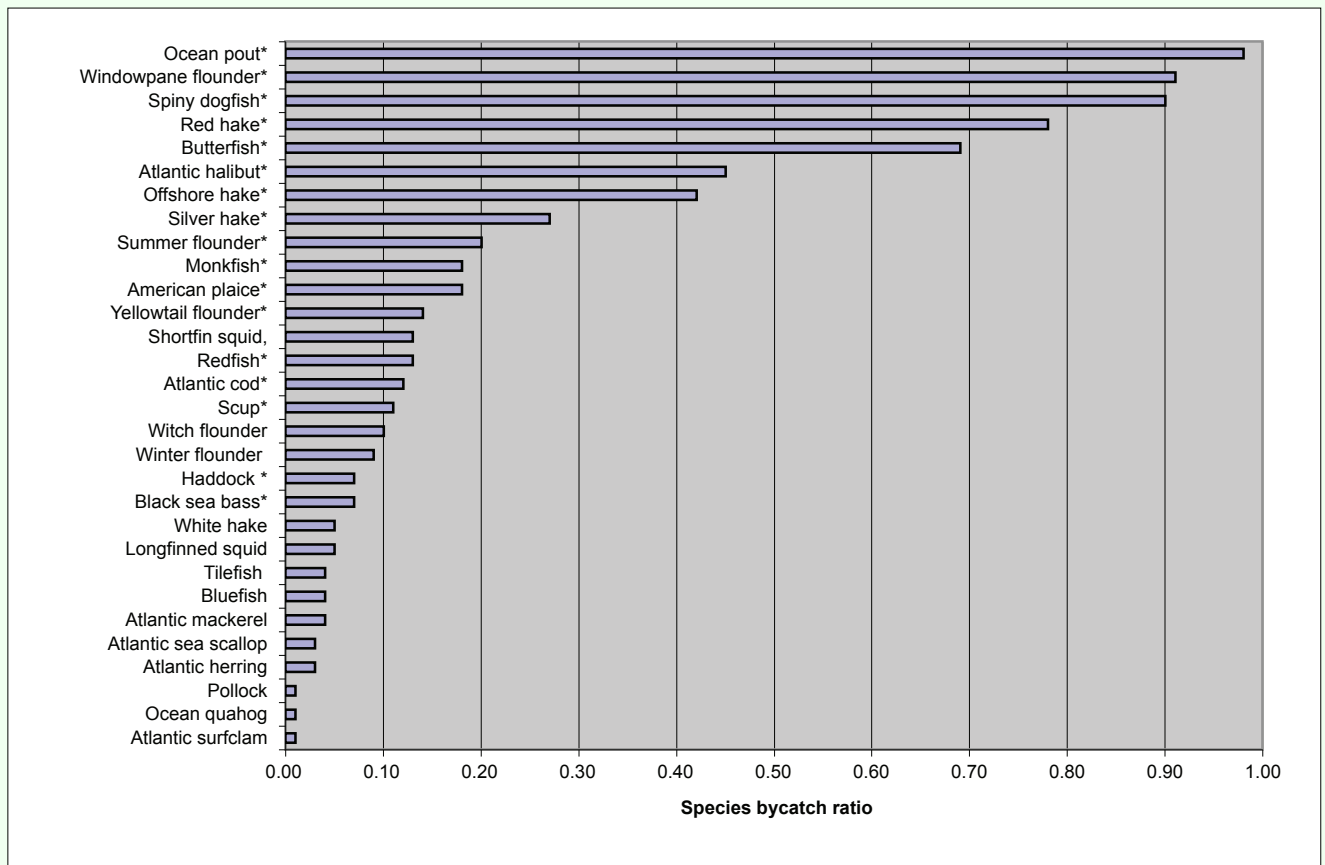


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## 5.6.1.1 Northeast Region Fish Bycatch

Fish and invertebrate bycatch estimates were provided for 34 Northeast Region stocks, with 21 identified as key stocks (Figure 5.8). Stock bycatch estimates ranged up to 79.6 M lb, with the highest estimated bycatch for the skate complex (see Section 4.1, Appendix table 4.1.A for this estimate). Fish stocks with high bycatch ratios included ocean pout (0.98), windowpane flounder (0.91), spiny dogfish (0.90), red hake (0.78), butterfish (0.69), Atlantic halibut (0.45), and offshore hake (0.42). Species with low stock bycatch ratios included Atlantic surfclams (<0.01), ocean quahog (<0.01),

pollock (0.01), Atlantic sea scallop (0.03), and Atlantic herring (0.03). A stock bycatch ratio was not presented for the skate complex because it comprises seven stocks, and the bycaught species may be different from the landed stocks. No stock bycatch ratios were provided for Atlantic salmon and shortnose sturgeon because landings are prohibited for these ESA-listed species, nor for red crab due to confidentiality of the commercial landings. Nineteen FSSI stocks and two ESA-listed stocks were identified as key fish stocks; the majority of these were classified as overfished in the 2008 First Quarter FSSI report.



**Figure 5.8**  
Stock bycatch ratios for the Northeast Region (2005 data). \* indicates key stocks. Northeast region key stocks without bycatch ratios: skate complex and Atlantic salmon (zero bycatch).

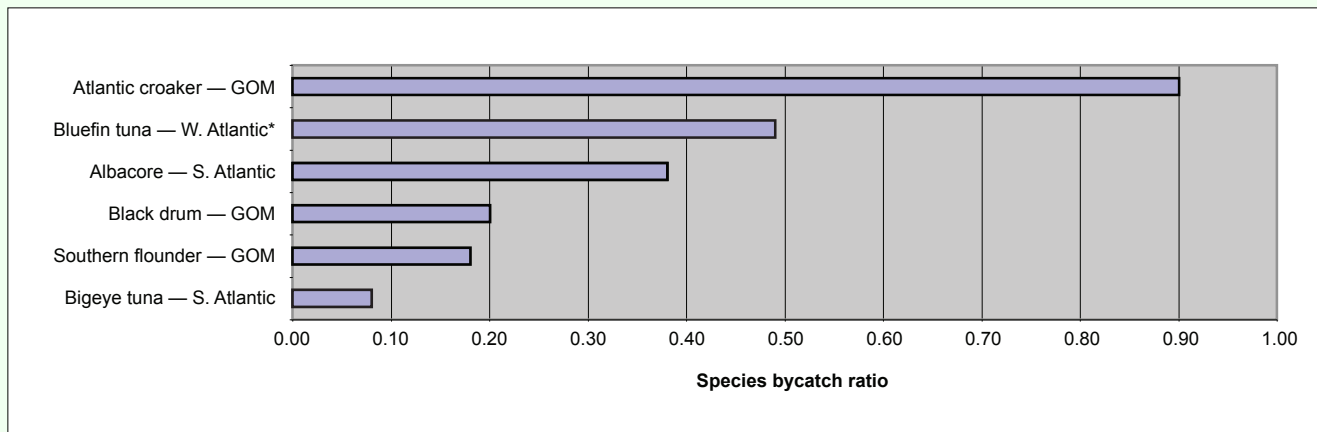
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### 5.6.1.2 Southeast Region Fish Bycatch

Fish bycatch estimates were calculated for 206 Southeast Region fish stocks, with 64 identified as key stocks (Figure 5.9). In some cases, bycatch and landings were reported by weight, and in other cases by numbers. Therefore, it was possible only to develop bycatch ratios for a small subset of these. For those stocks where stock bycatch ratios were calculated, the highest ratios were for the Gulf of Mexico Atlantic croaker stock (0.90), the West Atlantic bluefin tuna stock<sup>4</sup> (0.49), and the South Atlantic albacore stock (0.38). Of these, only the West Atlantic bluefin tuna stock was identified as a key stock. For fish stocks where bycatch

ratios could not be developed, species with high bycatch estimates included Gulf of Mexico seatrout and weakfish (58.7 M lb), non-Panaeid shrimp (88 M lb), longspine porgy (61.5 M lb), tiger shark (2.0 M lb), and Gulf of Mexico Spanish mackerel (3.6 M lb). These stocks, however, were not identified as key stocks. Key stocks with high bycatch estimates included red snapper (estimates in both number of fish, 1.7 M, and pounds, 2.6 M lb), red grouper (estimates in both number of fish, 862.1 K, and pounds, 57.8 K lb), South Atlantic/Gulf of Mexico dusky shark (570 K lb), greater amberjack (266 K fish), Gulf of Mexico lane snapper (1.6 M lb), and South Atlantic/Gulf of Mexico great hammerhead shark (191.8 K lb). The majority of these key stocks were subject to overfishing and were also overfished, as classified in the 2008 First Quarter FSSI report.

<sup>4</sup> Regulations prohibit targeting the Western Atlantic stock of bluefin tuna.



**Figure 5.9**

Stock bycatch ratios for the Southeast Region (2005 data). GOM = Gulf of Mexico. \* indicates key stocks. Southeast Region key stocks without bycatch ratios: black grouper, black sea bass, black snapper, blackfin snapper, blue marlin, blue shark, bull shark, cobia, dolphinfish, dusky shark, gag grouper, goliath grouper, gray snapper, great hammerhead shark, greater amberjack, Gulf sturgeon, hogfish, king mackerel, lane snapper, little tunny, lemon shark, Nassau grouper, red drum, red grouper, red porgy, red snapper, sailfish, sandbar shark, scalloped hammerhead, scamp, shortnose sturgeon, silk snapper, silky shark, smalltooth sawfish, snowy grouper, Spanish mackerel, speckled hind, spinner shark, Warsaw grouper, white grunt, white marlin, wreckfish, yellow-ledge grouper, yellowfin grouper.

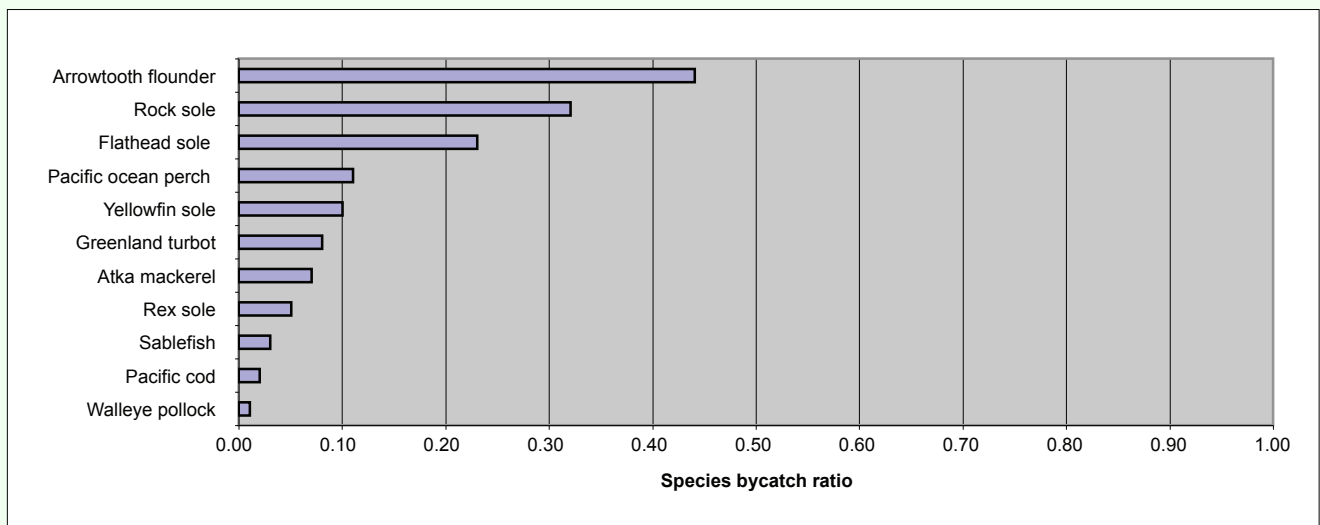
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## 5.6.1.3 Alaska Region Fish Bycatch

Bycatch estimates were provided for 73 Alaska Region fish and invertebrate stocks, with six identified as key stocks: red king crab (four distinct stocks), Aleutian Islands golden king crab, blue king crab, the demersal shelf rockfish complex (seven species), Chinook salmon, and non-Chinook salmon (Figure 5.10). Estimated bycatch ranged from trace amounts to 41.6 M lb. The highest estimated bycatch was for walleye pollock (41.6 M lb), BSAI arrowtooth flounder (32.4 M lb), rocksole (28.7 M lb), and yellowfin sole (20.0M lb); abundance and harvest levels were very high for these stocks and overall bycatch represented only a small fraction of total fishing mortality. Bycatch estimates for the four key stocks were relatively low, although landings data were not available because retention of these stocks in Federal groundfish fisheries is prohibited. Key stock bycatch estimates were 630 K lb for red king crab; 17 K lb. for Aleutian Islands golden king crab; 5.4 K lb for blue king crab;

and 160 lb for demersal shelf rockfish. In many cases, bycatch of target species comprised a substantial proportion of overall bycatch in a specific fishery, due to discard of undersize or otherwise undesirable species. For example, bycatch of Atka mackerel comprised 31% of overall bycatch in the BSAI Atka mackerel trawl fishery; and Pacific cod comprised 12% of the total bycatch in the BSAI Pacific cod longline fishery.

Quantity or proportion of bycatch may not be a good indicator of the need for concern. This is certainly the case for key stocks where even small quantities of bycatch are an important consideration in the management of the species. Examples include the Chinook salmon and non-Chinook salmon key stock categories. Bycatch of Pacific salmon species in the BSAI pollock trawl fishery was small as a proportion of the overall catch; nevertheless, there is concern regarding the impacts of this bycatch on some of the stocks from which they originate.



**Figure 5.10**

Stock bycatch ratios for Alaska Region (2005 data). Alaska Region key stocks without bycatch ratios are red king crab (four stocks), Aleutian Islands golden king crab, blue king crab, the demersal shelf rockfish complex (seven species), Chinook salmon, and non-Chinook salmon. \* indicates key stocks.



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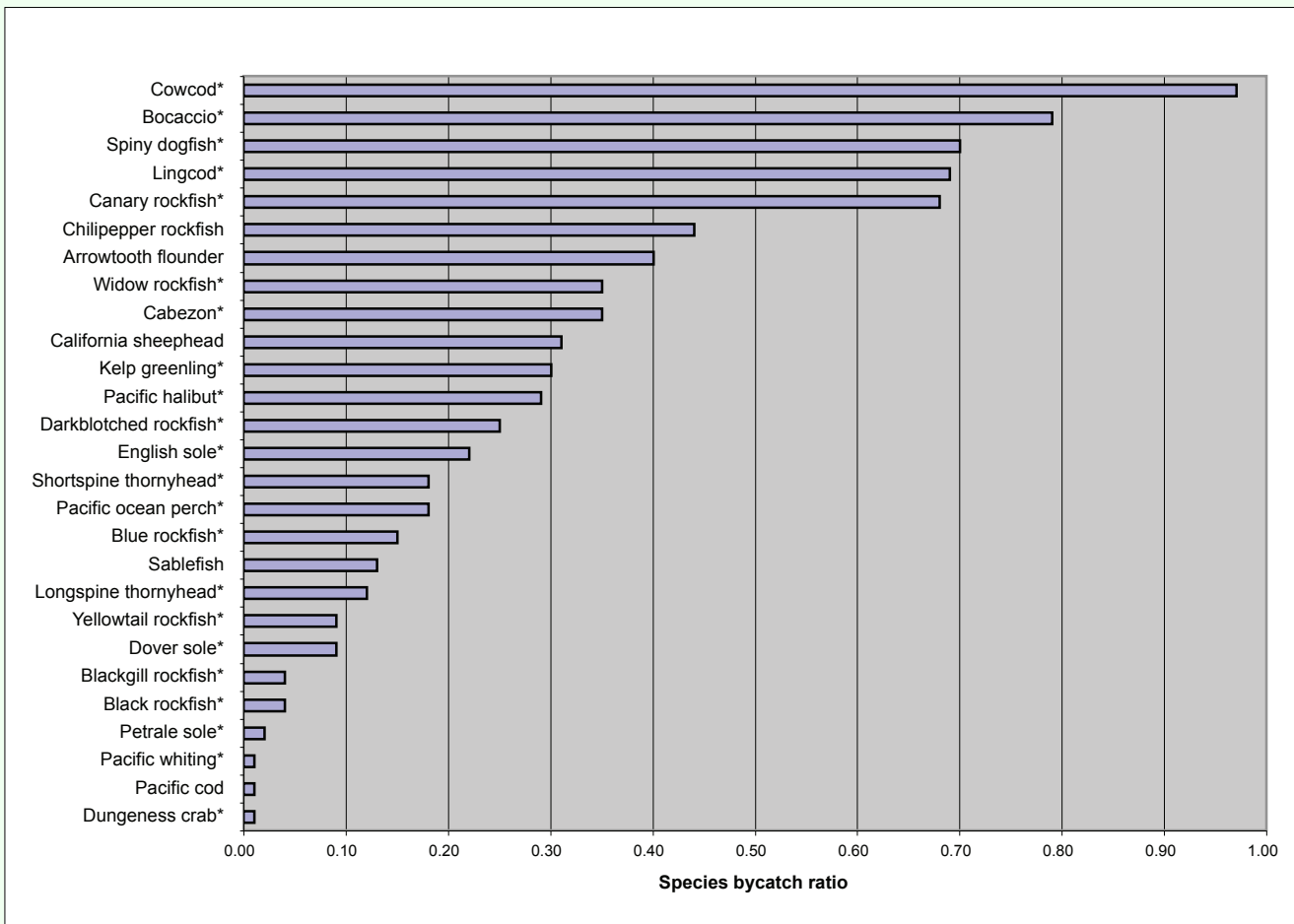
### 5.6.1.4 Northwest Region Fish Bycatch

Fish bycatch estimates were provided for 53 Northwest Region fish stocks, with 33 identified as key stocks (Figure 5.11). Overall, stock bycatch ratios ranged from 0.01 to 0.97. The highest bycatch estimates were reported for arrowtooth flounder (3.2 M lb), Pacific hake (3.0 M lb), and spiny dogfish (2.8 M lb). Although the bycatch for Pacific hake was high, the stock bycatch ratio was very low at 0.01. The stock bycatch ratios for arrowtooth flounder and spiny dogfish were 0.40 and 0.70, respectively. Stocks with the highest stock bycatch ratios included cowcod (0.97), bocaccio (0.79), and canary rockfish (0.68). As these stocks are overfished, landings are extremely restricted or prohibited by fishery management;<sup>5</sup> therefore, the majority of the catch of these stocks is discarded (hence the high stock

bycatch ratio shown in Figure 5.11). Some fish stocks were identified in the Northwest Region as key stocks due to the potential for high bycatch mortality. FSSI stocks were identified as key stocks, with none of the stocks experiencing overfishing. Cowcod, bocaccio, darkblotched rockfish, and yelloweye rockfish stocks were classified as overfished in the 2008 First Quarter FSSI report.

All catch and bycatch of managed fish and invertebrate stocks are accounted for in stock assessments and fishery management. Each year, total mortality estimates are calculated for most Northwest fisheries. These estimates include the retained and discarded components of catch. When computing total mortality, rates of survivorship (less than 100% mortality) are applied for some individual species or species groups. These survivorship rates were not applied in the bycatch estimates included in this report. Quantity or proportion of bycatch may not be the only indicator of concern. Low levels of bycatch may be of greater concern for those species whose populations are less abundant and/or overfished.

<sup>5</sup> As of 2005, cowcod was prohibited from retention in all sectors of the groundfish fishery. Bocaccio and canary rockfish had very restricted retention limits in some sectors of the groundfish fishery and were prohibited in others, but some overall retention was still allowed in the 2005 fishery.



**Figure 5.11**  
Stock bycatch ratios for the Northwest Region (2005 data). \* indicates key stocks.

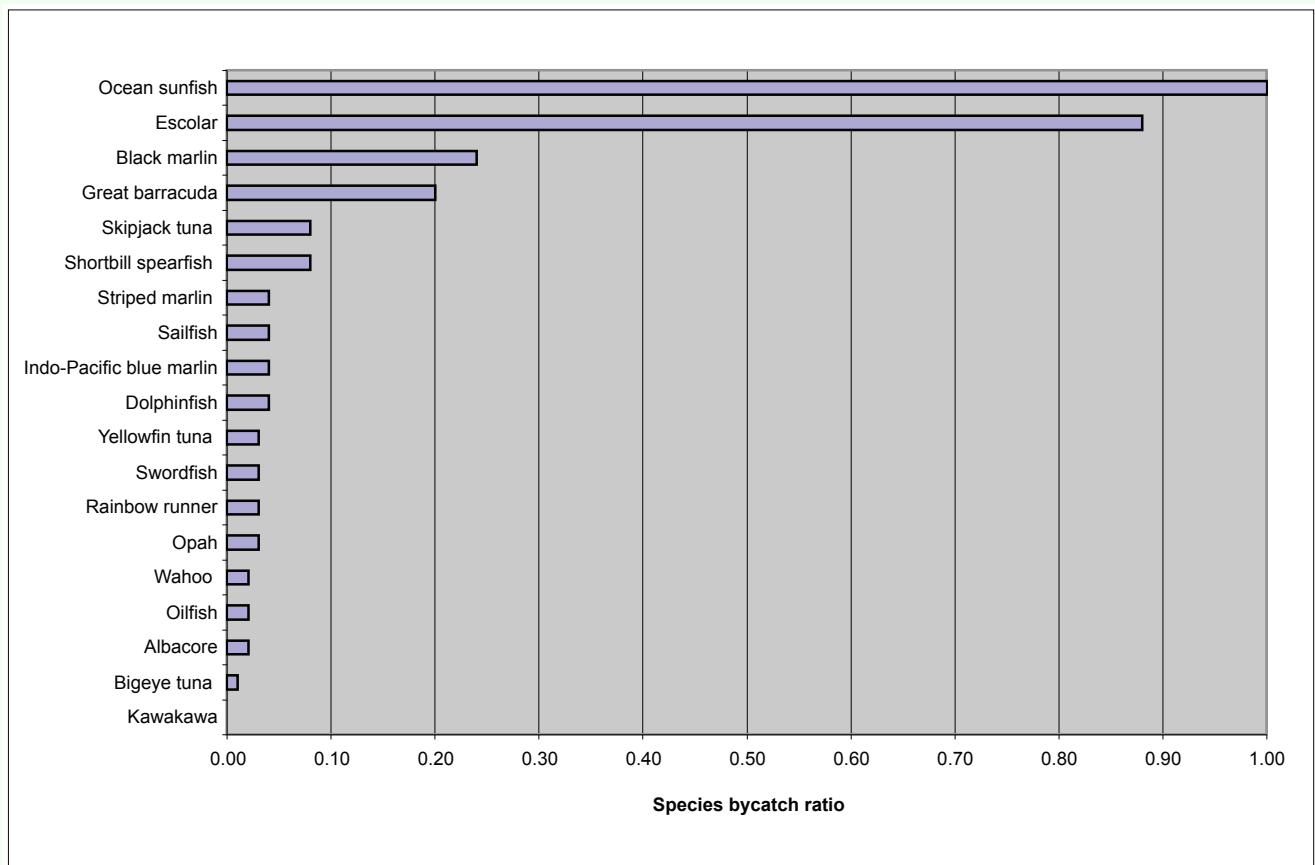
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## 5.6.1.5 Southwest Region Fish Bycatch

Fish and invertebrate bycatch estimates were not calculated for Southwest Region commercial fisheries at the time this report was drafted. Recently published bycatch estimates of fish, sharks, and invertebrates in the California swordfish drift gillnet fishery (Larese and Coan 2008) will be included in the next edition of the U.S. National Bycatch Report. Fish and invertebrate bycatch estimates for the California halibut and white seabass set gillnet fisheries will also be included.

## 5.6.1.6 Pacific Islands Region Fish Bycatch

Fish bycatch estimates were provided for a total of 89 Pacific Islands stocks, with three stocks classified as key stocks (Figure 5.12). The range in overall bycatch estimates for all stocks was 0 to 5.6 M lb. Stock bycatch ratios ranged from 0 to 1.0, with the majority of stocks having very low bycatch ratios. The highest bycatch ratios occurred for the ocean sunfish (1.0) and escolar (0.88). The high ratios for both of these stocks reflect how seldom they are landed (the ratio is equal to one if none are landed). The estimated catches of ocean sunfish and escolar in these fisheries in 2005 were 85 and 3,300 individuals, respectively. The three key Pacific Islands fish stocks identified in this report were bigeye thresher shark (432.8 K lb), blue shark (5.6 M lb), and longnose lancetfish (927.7 K lb). Bycatch ratios were not calculated for these stocks since landings at the national level were reported for sharks in general, and longnose lancetfish were rarely landed. Blue shark stocks were identified as key because they are FSSI stocks.



**Figure 5.12**

Stock bycatch ratios for the Pacific Islands Region (2005 data). Pacific Islands Region key stocks without bycatch ratios: bigeye thresher shark, blue shark, longnose lancetfish.

## 5.6.2 Marine Mammal Bycatch

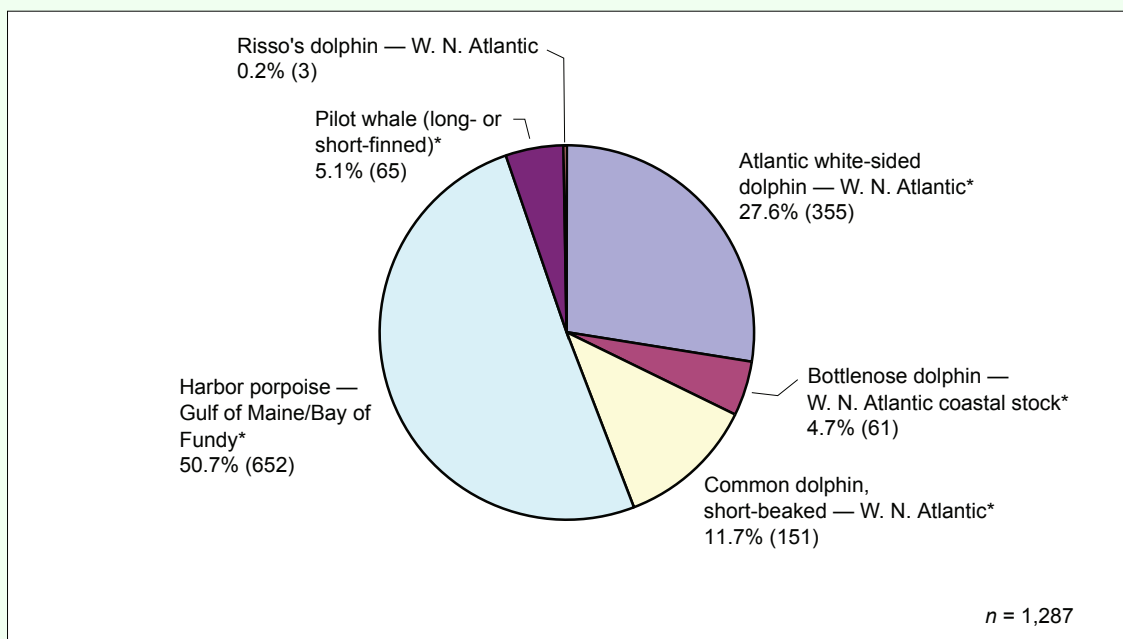
The total bycatch estimate (lethal takes and serious injuries) for marine mammals for 39 fisheries and 54 marine mammal stocks was 1,887 individual animals (Figures 5.13–5.19). The number of bycatch estimates varied by region, as discussed in the following sections. Some estimates contain decimals due to averaging across years.

### 5.6.2.1 Northeast Region Marine Mammal Bycatch

Marine mammal bycatch estimates were provided for 15 Northeast Region commercial fisheries; there was no documented marine mammal bycatch during 2001–2005 for the majority of the other Northeast fisheries. The Mid-Atlantic mid-water trawl fishery produced an average annual bycatch of 91 animals, while the Mid-Atlantic otter trawl fishery produced an annual average of 182 animals, 118 of which were western North Atlantic short-beaked common dolphin. The Mid-Atlantic and New England gillnet fisheries and the New England otter trawl fishery had the high-

est marine mammal bycatch estimates, ranging from 238 to 514 animals per year. Bycatch in the gillnet fisheries was mainly harbor porpoises (Gulf of Maine/Bay of Fundy stock), with an annual average of 177 animals bycaught in the Mid-Atlantic gillnet fishery and 475 bycaught in the New England gillnet fishery. Western North Atlantic white-sided dolphin was the most commonly bycaught species in the New England otter trawl fishery, with an annual average of 192 animals.

Marine mammal bycatch estimates were provided for six stocks, with five identified as key stocks (Figure 5.13). The total marine mammal bycatch estimate was 1,287 animals per year (2001–05 average). The stocks with the highest average annual bycatch estimates included the Gulf of Maine/Bay of Fundy stock of harbor porpoise (652 animals), western North Atlantic white-sided dolphin (355 animals), and western North Atlantic short-beaked common dolphin (151 animals). These were followed by pilot whale (65 animals), the western North Atlantic coastal stock of bottlenose dolphin (61 animals), and western North Atlantic Risso's dolphin (3 animals). The status of these stocks was unknown.



**Figure 5.13**

Marine mammal bycatch (lethal + serious injury) in the Northeast Region (*n* = total number of bycaught animals). The baseline year of data used in this report was 2005, however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.

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## 5.6.2.2 Southeast Region Marine Mammal Bycatch

Marine mammal bycatch estimates were provided for three Southeast Region commercial fisheries. Bycatch in the large and small coastal shark aggregate fisheries (drift, strike, and bottom gillnet) was relatively low, with an estimate of five bottlenose dolphins bycaught annually. Average annual marine mammal bycatch in the Southeastern Atlantic and Gulf of Mexico HMS pelagic longline and shark bottom longline fisheries was 116 and 100 animals, respectively. In the HMS pelagic longline fishery, 70 pilot whales and 46 Risso's dolphins, as well as both spotted pantropical and Atlantic spotted dolphin (both western N. Atlantic stocks) were taken, while bottlenose dolphin was the only species bycaught in the shark bottom longline fishery.

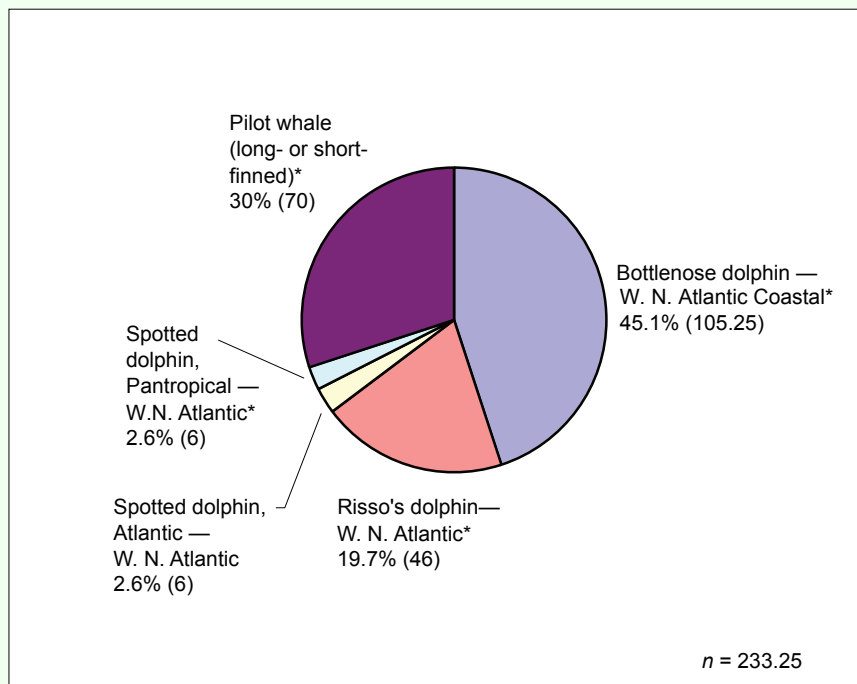
Marine mammal bycatch estimates were provided for five stocks, with four identified as key stocks (Figure 5.14). The total number of marine mammals bycaught in the Southeast Region was 233.25 animals. The majority of the bycatch was western North Atlantic coastal bottlenose dolphin, with 105 animals. Seventy long-finned or short-finned pilot whales and 46 western North Atlantic Risso's dolphins were also bycaught. Status for these key marine mammal stocks is either varied or unknown.

## 5.6.2.3 Alaska Region Marine Mammal Bycatch

Marine mammal bycatch estimates were provided for 13 Alaska Region commercial fisheries, with bycatch estimates ranging from 0.20 to 35.8 animals per year (note that annual estimates are based on multi-year averages, hence some values are fractional). Four of these fisheries are State of Alaska salmon gillnet fisheries located in Cook Inlet, Kodiak, Yakutat, and Southeast Alaska (AMMOP fisheries). Bycatch data were obtained from the North Pacific Groundfish Observer Program, AMMOP, and/or from stranding network data. Only very low levels of bycatch (central North Pacific humpback whale bycatch; 0.2 animals/yr) were estimated for the Cook Inlet, Yakutat, and Southeast fisheries. For the Kodiak fishery, however, an annual bycatch estimate of 35.8 animals (harbor porpoise, GOA stock) was reported.

Although average annual marine mammal bycatch estimates were numerically very low for the majority of nine groundfish fisheries with bycatch estimates, a serious injury or mortality problem may still exist (i.e., even a small amount of bycatch may be significant).

- For the BSAI Atka mackerel trawl fishery, only Steller sea lions (western stock) were taken, with an average annual mortality of 0.49 animals.



**Figure 5.14**

Marine mammal bycatch (lethal + serious injury) in the Southeast Region ( $n$  = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Note: Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.



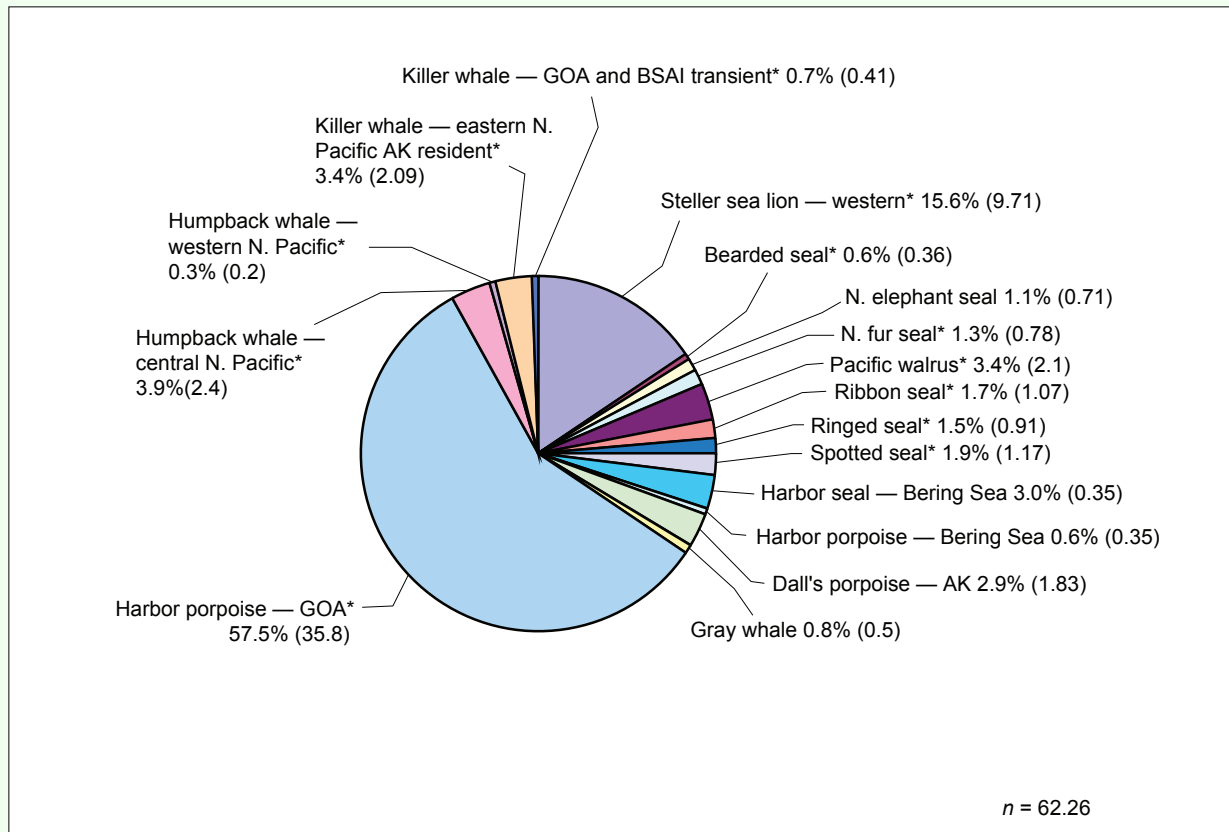
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- For the BSAI flatfish trawl fisheries, average annual marine mammal bycatch mortality was 9.72 animals and was comprised of western Steller sea lion (2.78), spotted seal (1.17), ringed seal (0.49), ribbon seal (0.27), Pacific walrus (2.10), northern fur seal (0.57), Bering sea harbor seal (0.79), Bering sea harbor porpoise (0.35), killer whale – Eastern North Pacific Alaska resident stock (0.84), and bearded seal (0.36).
- For the BSAI Pacific cod longline fishery, average annual marine mammal bycatch mortality was 2.18 animals and was comprised of killer whale—Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock (0.84), ribbon seal (0.60), and western Steller sea lion (0.74).
- For the BSAI Pacific cod trawl fishery, average annual marine mammal bycatch mortality was 1.64 animals, comprised of Bering Sea harbor seal (0.79) and western Steller sea lion (0.85).
- For the BSAI pollock pelagic trawl fishery, average annual marine mammal bycatch mortality was 5.46 animals, including western Steller sea lion (2.58), ringed seal

(0.42), ribbon seal (0.20), northern fur seal (0.21), Bering Sea harbor seal (0.29), Dall's porpoise (1.35), and killer whale—Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock (0.41).

- For the BSAI sablefish pot fishery, overall marine mammal bycatch was estimated at 0.20 animals per year, comprised of central North Pacific and western North Pacific humpback whale, in equal proportions.
- For the GOA crab pot fishery, only central North Pacific humpback whale bycatch mortality was reported (0.60).
- For the GOA pollock pelagic trawl fishery, marine mammal bycatch mortality was estimated at 2.52 animals per year, consisting of Dall's porpoise (0.48), northern elephant seal (0.71), and western Steller sea lion (1.33). For the GOA Pacific cod trawl fishery, only western Steller sea lion bycatch was reported (0.94).

Marine mammal bycatch was calculated for 17 stocks, with 12 identified as key stocks (Figure 5.15). The total annual marine mammal bycatch estimated for the BSAI and GOA



**Figure 5.15**

Marine mammal bycatch (lethal + serious injury) in the Alaska Region (*n* = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Note: zero estimates are not shown. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.

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was 61 animals; 35 were Gulf of Alaska harbor porpoises (documented from a single fishery) and 10 were western Steller sea lions from several fisheries. Lower levels of estimated bycatch of key stocks included bearded seal (<1 animal), humpback whale (0.2–2.4), killer whale (0.4–2.1), Northern fur seal (0.8), Pacific walrus (2.1), ribbon seal (1.1), ringed seal (0.9), and spotted seal (1.2). For the majority of these stocks, ZMRG and stock status is unknown or declining. The western Steller sea lion is listed as endangered.

## 5.6.2.4 Northwest Region Marine Mammal Bycatch

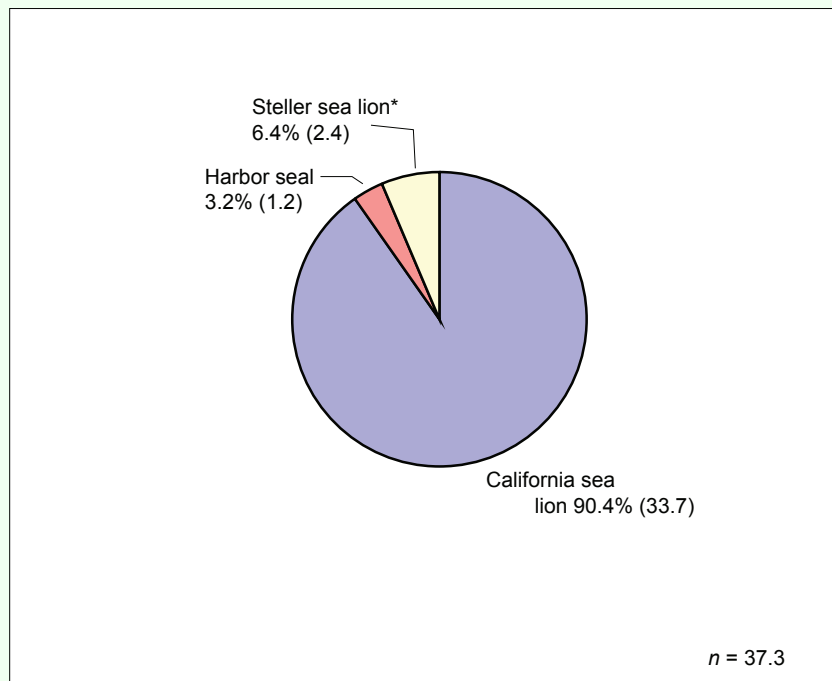
Marine mammal bycatch estimates were provided for 2005 for five Northwest Region commercial fisheries. Although bycatch estimates were based on a single year of data, some fractional values were reported due to the estimation process. No marine mammal bycatch occurred in the West Coast groundfish non-trawl gear (non-endorsed fixed gear) or the California/Oregon nearshore rockfish fishery. Low levels of bycatch occurred in the West Coast ground-

fish non-trawl gear (sablefish-endorsed fixed gear) fishery (14 California sea lions), the West Coast limited-entry bottom trawl (groundfish bottom trawl) fishery (20 California sea lions), and the West Coast mid-water hake trawl fishery for at-sea processors (four animals).

Marine mammal bycatch estimates were provided for three Northwest Region stocks, with one stock identified as a key stock (Figure 5.16). Total annual marine mammal bycatch in the West Coast fisheries was estimated at 37 animals. The highest species bycatch was for the California sea lion stock, with 33.7 animals. The only key marine mammal stock identified was the Steller sea lion, with an annual bycatch estimate of 2.4 animals.

## 5.6.2.5 Southwest Region Marine Mammal Bycatch

Estimates of marine mammal bycatch from three California commercial fisheries were calculated. Bycatch estimates were provided for eight stocks, four of which were classified as key stocks (Figure 5.17). Annual bycatch estimates



**Figure 5.16**

Marine mammal bycatch (lethal + serious injury) in the Northwest Region (*n* = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species, multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.

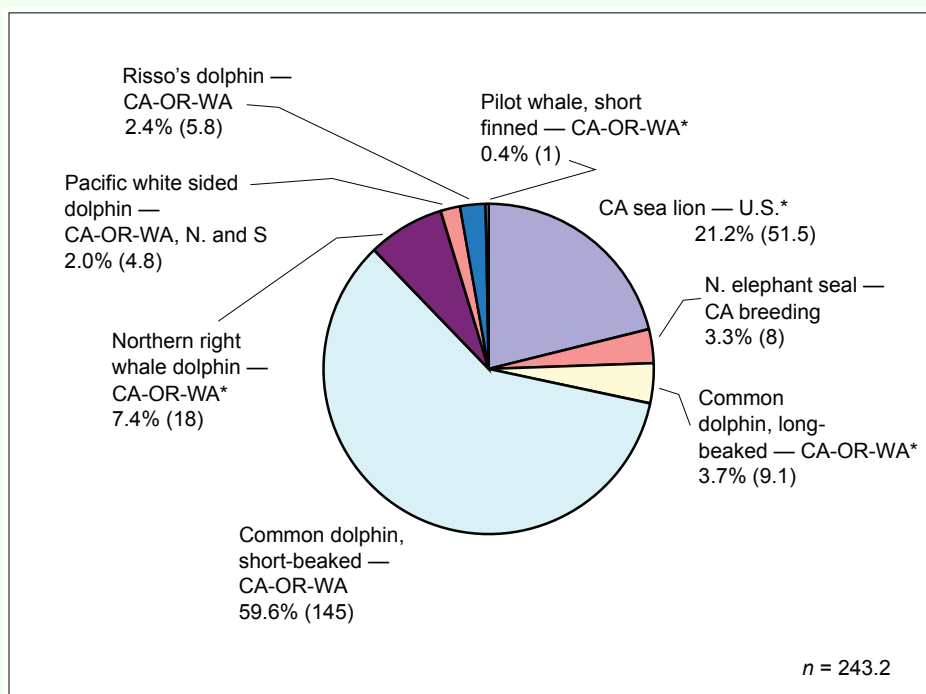
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ranged from 1 to 145 animals (common short-beaked dolphin CA/OR/WA). Bycatch estimates for the key populations were 51.5 California sea lions (U.S.), 9.1 common long-beaked dolphin (CA/OR/WA), 18 northern right whale dolphin (CA/OR/WA), and one short-finned pilot whale. The majority of marine mammal stocks identified as key stocks in the Southwest region have unknown stock status.

The highest bycatch levels were from the California drift gillnet fishery for swordfish and thresher shark, which has had an observer program since 1990. For the period 2000–04, annual average marine mammal mortality in this fishery was 38 California sea lions, 4.4 long-beaked common dolphin, 58 short-beaked common dolphin, eight northern elephant seals, 18 northern right whale dolphin, 4.8 Pacific white-sided dolphin, 5.8 Risso's dolphin, and 1 short-finned pilot whale. In recent years, cetacean entanglements in this fishery have averaged approximately four per 100 sets fished. Current cetacean bycatch rates in the drift gillnet fishery are significantly lower since acoustic pingers were introduced into this fishery in the mid-1990s (Barlow and Cameron 2003; Carretta et al. 2008). Bycatch in the Cali-

fornia squid purse seine fishery averaged 87 short-beaked common dolphin, although this estimate had a high degree of uncertainty due to the low level of observer coverage. Annual bycatch in the California white seabass and yellow-tail small-mesh drift gillnet fisheries was estimated to average 13.5 California sea lions and 4.7 long-beaked common dolphin, respectively.

Of the three Southwest fisheries for which cetacean and pinniped bycatch were reported, only one, the swordfish gillnet fishery, currently has an observer program. Total bycatch over all three fisheries was 51.5 California sea lions, 9.1 long-beaked common dolphin, 145 short-beaked common dolphin, eight northern elephant seals, 18 northern right whale dolphin, 4.8 Pacific white-sided dolphin, 5.8 Risso's dolphin, and one short-finned pilot whale. Because not all fisheries were observed in all years, these estimates should be considered minimum bycatch estimates. These bycatch estimates appear in the U.S. Pacific Marine Mammal Stock Assessments, which are published annually. More recent estimates of marine mammal bycatch are available in the 2008 U.S. Pacific Stock Assessment Report (Carretta et al. 2009).



**Figure 5.17**

Marine mammal bycatch (lethal + serious injury) in the Southwest Region ( $n$  = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.

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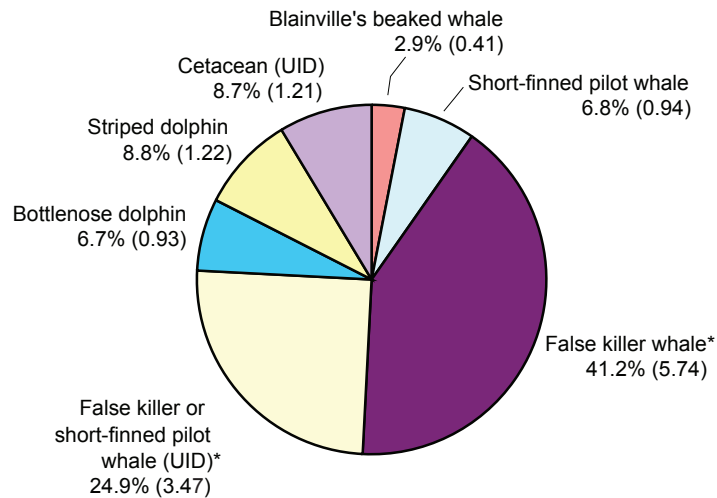
## 5.6.2.6 Pacific Islands Region Marine Mammal Bycatch

An annual average, over five years, of one marine mammal was observed caught in the Hawaii-based shallow-set pelagic longline fishery for swordfish within and outside the Hawaiian EEZ, while minimal bycatch was observed within and outside the Hawaiian EEZ in the deep-set pelagic longline fishery for tuna (an annual average of approximately 25.23 animals from 15 separate marine mammal stocks).

Marine mammal bycatch estimates were provided for a total of 15 stocks, with four identified as key stocks (Figures 5.18 and 5.19). Bycatch ranged from 0 to 7.62 animals, reported for specific fisheries rather than for stocks. The key stocks included false killer whale, unidentified false killer whale or short-finned pilot whale, humpback whale, and sperm whale. The stock status of false killer whale stock is unknown, while humpback and sperm whales are listed as endangered under the ESA.

**Figure 5.18**

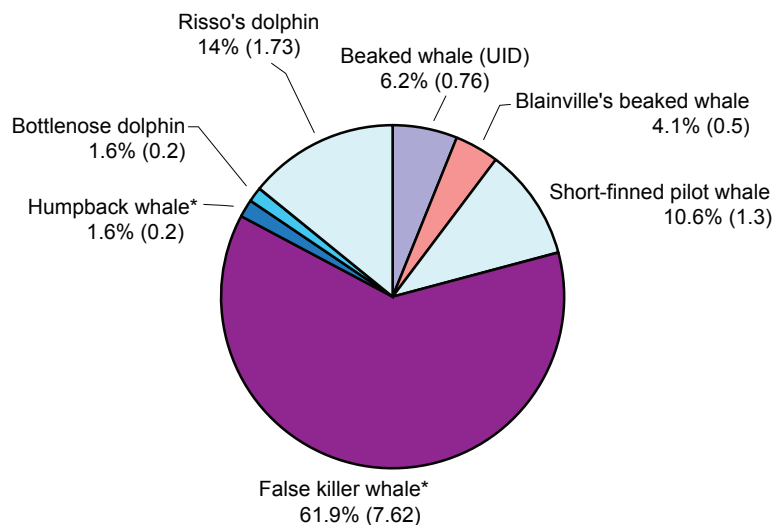
Marine mammal bycatch (lethal + serious injury) in the Pacific Islands Region, within the EEZ ( $n$  = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks. UID = unidentified.



Inside U.S. EEZ;  $n = 13.92$

**Figure 5.19**

Marine mammal bycatch (lethal + serious injury) in the Pacific Islands Region beyond the EEZ ( $n$  = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks. UID = unidentified.



Outside U.S. EEZ;  $n = 12.31$



### 5.6.3 Sea Turtle Bycatch

Estimates for bycatch of turtles from all U.S. sea turtle populations were calculated for 21 fisheries, and totaled 11,772 individual animals. Sea turtle bycatch estimates were not calculated for Alaskan fisheries, since sea turtles do not typically occur in this region. Also, sea turtle bycatch was not observed in any Northwest Region fisheries. The highest sea turtle bycatch estimates were for the Southeast Region, with estimates reported for ten fisheries and four sea turtle populations (and also for unidentified turtles), with a total bycatch estimate of 10,671 individuals (note shrimp trawl fishery estimates included mortalities only). Most bycaught sea turtles were loggerhead (5,209 animals), Kemp's ridley (4,222), and leatherback (537). These turtles were bycaught mainly in the reef fish, Atlantic pelagic longline, and southeastern Atlantic and Gulf of Mexico shrimp trawl fisheries.<sup>6</sup> Note that the proportion of the total stocks that these estimates represent is generally unknown because of the general lack of population size estimates for sea turtles.

Some estimates were based on multiple years of data, and may be fractional due to averaging across years.

#### 5.6.3.1 Northeast Region Sea Turtle Bycatch

Sea turtle bycatch estimates were provided for nine Northeast Region commercial fisheries, with the majority of other Northeast fisheries having no documented sea turtle bycatch. Bycatch estimates were presented for loggerhead turtles only, because this was the only species with enough observed interactions to produce a defensible estimate. Loggerhead sea turtles are currently listed as threatened under the ESA, and are thus a key stock. Estimated bycatch for the loggerhead sea turtle during 1996–2005 in the Northeast Region, across the nine gear types presented, was 1,062 loggerhead sea turtles per year, with an estimated annual average of 136 in the Mid-Atlantic scallop trawl fishery (2004–05), 310 in the Mid-Atlantic scallop dredge fishery (2003–05), and 616 in the Mid-Atlantic otter trawl fishery (1996–2004).

#### 5.6.3.2 Southeast Region Sea Turtle Bycatch

Estimates of sea turtle bycatch were provided for ten Southeast Region commercial fisheries. The bycatch estimates encompassed years 2001–06, depending on the fishery (more recent data were used to estimate bycatch of rare-event species). Low numbers of bycaught sea turtles were reported in the Gulf of Mexico reef fish bottom longline fishery (10 unclassified turtles), the Gulf of Mexico reef fish handline fishery (24 loggerheads), the large and small coastal shark aggregate fisheries (5 loggerheads),

<sup>6</sup> Bycatch estimates from the 2002 shrimp trawl fishery Biological Opinion. Since that time, effort in the shrimp fishery, and related bycatch, have decreased substantially.



Credit: NOAA

A loggerhead sea turtle.

and the South Atlantic snapper–grouper handline fishery (3 individuals). It should be noted that any bycatch of these ESA-listed species is of concern and more recent observer data may indicate higher bycatch levels in these fisheries. For example, a September 2008 report indicated Gulf of Mexico reef fish bottom longline gear took between 339 and 1,884 loggerhead sea turtles over an 18-month period (July 2006–December 2007; a monthly average of 800) based on extrapolation of observer data during that time period.<sup>7</sup>

Higher levels of estimated sea turtle bycatch were found in pound net, longline, and trawl fisheries. Total sea turtle bycatch estimated for the North Carolina southern flounder pound net fishery was 657 animals, with 536 loggerheads, 107 green turtles, and 13.6 Kemp's ridley turtles. Total sea turtle bycatch estimated for the Atlantic and Gulf of Mexico HMS pelagic longline fishery was similar, at 625 animals (350.9 leatherback and 273.8 loggerhead turtles), as was the Atlantic and Gulf of Mexico Shark Bottom Longline fishery (83.2 leatherback and 420 loggerhead turtles, plus nearly 32 unidentified sea turtles). The bycatch in the North Carolina inshore gillnet fishery was 60 animals (37 green, 19 leatherback, and 4 loggerhead turtles).

The Gulf of Mexico and Southeastern Atlantic shrimp trawl fisheries had the highest bycatch estimates, at 6,849 and 1,901 sea turtles, respectively. The majority of bycaught

<sup>7</sup> <http://sero.nmfs.noaa.gov/pr/pdf/SEFSC2008.pdf>

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sea turtles were Kemp's ridley (3,884 in the Gulf of Mexico and 324 in the South Atlantic) and loggerheads (2,416 in the Gulf of Mexico and 1,532 in the South Atlantic). Note that estimates for both shrimp trawl fisheries were based on levels of fishery effort reported in 2001 (NMFS 2002) and since that time, effort (and presumably bycatch) have decreased.

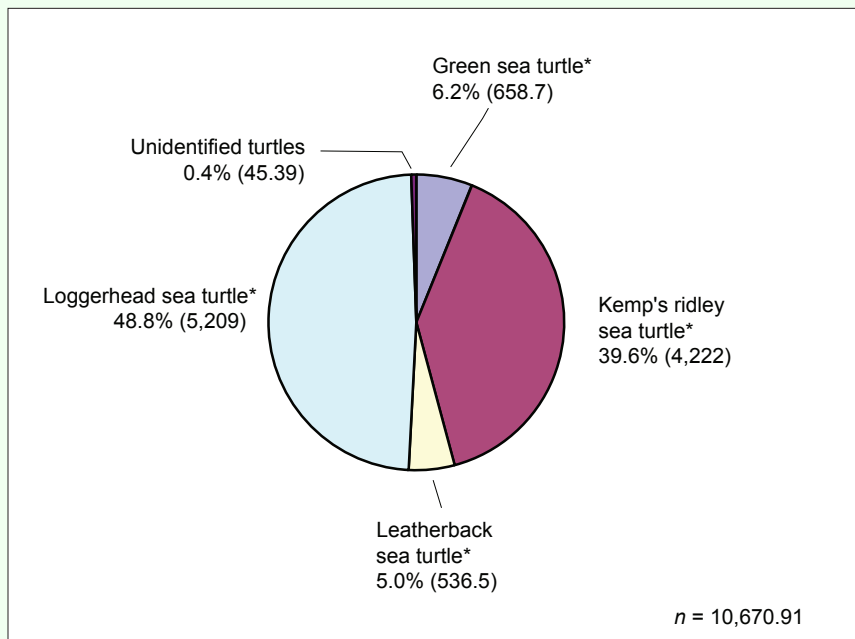
Four of the populations with bycatch estimates were identified as key stocks (Figure 5.20); the fifth set of estimates were for unidentified animals. The total number of sea turtles bycaught in the Southeast Region was 10,671 animals. The highest bycatch occurred for loggerhead sea turtles (5,209 animals) and Kemp's ridley (4,222 animals). Loggerhead and leatherback sea turtles are listed as threatened and endangered, respectively, under the ESA.

## 5.6.3.3 Alaska Region Sea Turtle Bycatch

Sea turtle bycatch estimates were not provided for any Alaska Region commercial fisheries, since sea turtles do not typically occur in Alaska waters. Sea turtle bycatch has never been observed in Alaska, even with high levels of observer coverage in this region.

## 5.6.3.4 Northwest Region Sea Turtle Bycatch

Sea turtle bycatch estimates of zero were provided for five Northwest Region commercial fisheries. No bycatch of sea turtles has ever been observed.



**Figure 5.20**

Sea turtle bycatch in the Southeast Region ( $n$  = total number of bycaught animals). Estimates include mortalities and those individuals released alive for all regional fisheries, with the exception of the shrimp trawl fisheries, for which only estimates of mortalities are provided. The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.

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### 5.6.3.5 Southwest Region Sea Turtle Bycatch

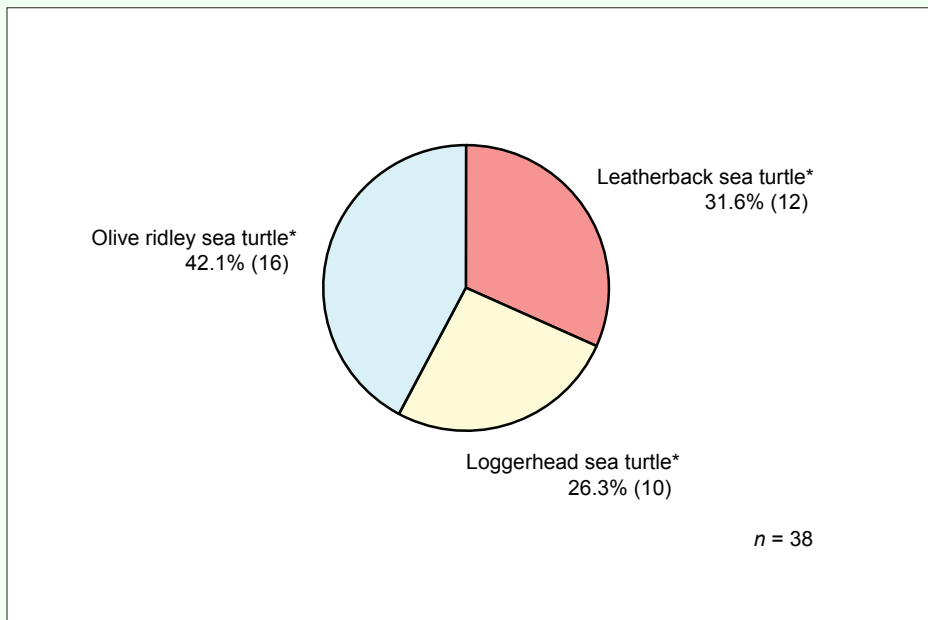
Sea turtle bycatch estimates were provided for one Southwest Region fishery, which cannot be identified due to confidentiality concerns. The bycatch consisted of one olive ridley sea turtle. This population was identified as a key stock by the Southwest Region.

### 5.6.3.6 Pacific Islands Region Sea Turtle Bycatch

Sea turtle bycatch was observed in the Hawaii-based shallow-set pelagic longline fishery (swordfish) and the Hawaii-based deep-set pelagic longline fishery (tuna), with an estimated total of 20 sea turtles bycaught in the deep-set and 18 loggerhead turtles in the shallow-set pelagic longline

fishery. The deep-set fishery bycatch was principally olive ridleys (16 of the 20 sea turtles).

Sea turtle bycatch estimates were provided for four populations, all identified as key stocks (Figure 5.21). Annual bycatch estimates ranged from zero to 16, with a total of 38 animals. Key stocks included green sea turtle (0 animals), leatherback turtle (12), loggerhead turtle (10), and olive ridley turtle (16). While green sea turtles are listed as threatened, the Florida and Mexico breeding populations of this species are listed as endangered. Due to the inability to distinguish between these populations away from the nesting beaches, NMFS considers green sea turtles endangered whenever they occur in U.S. waters. Loggerhead sea turtles are listed as threatened under the ESA, while leatherback and olive ridley sea turtles are listed as endangered.



**Figure 5.21**

Sea turtle bycatch in the Pacific Islands Region ( $n$  = total number of bycaught animals). Estimates include mortalities and those individuals released alive. The baseline year of data used in this report was 2005, however; for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.

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## 5.6.4 Seabird Bycatch

Bycatch estimates for seabirds were calculated for 25 fisheries, totaling 28 seabird populations and 7,769 individual bycaught animals (Figure 5.22–5.25). The number of bycatch estimates varied by region. The highest bycatch estimates were calculated for the Alaska Region and were provided for 16 fisheries, representing 12 seabird populations and totaling 7,280 seabirds.

### 5.6.4.1 Northeast Region Seabird Bycatch

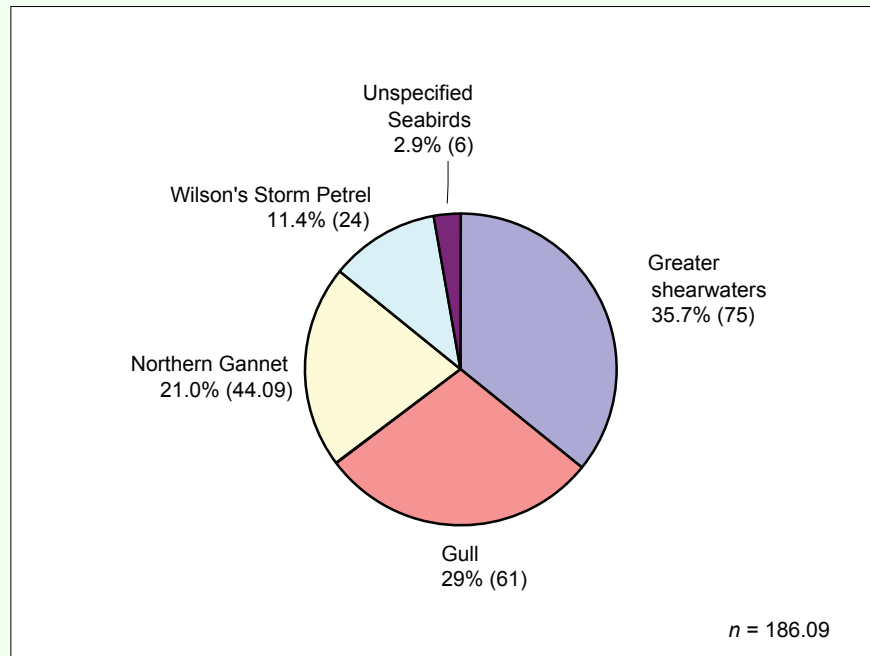
Seabird bycatch estimates were not calculated for the Northeast Region; estimation methods are currently being developed.

### 5.6.4.2 Southeast Region Seabird Bycatch

Seabird bycatch estimates were provided for two Southeast Region commercial fisheries. An estimated total of 24 seabirds were bycaught in the South Atlantic coastal migratory pelagic troll fishery and an estimated 142 seabirds were bycaught in the southeastern Atlantic and Gulf of Mexico HMS pelagic longline fishery. The majority of seabirds bycaught in the longline fishery were greater shearwater (75) and gulls (61).

Seabird bycatch estimates were provided for six populations, with none of these populations identified as key stocks (Figure 5.22). Total seabird bycatch in the Southeast Region was 186 animals.<sup>8</sup> The highest bycatch occurred for greater shearwaters and gulls.

<sup>8</sup> This is an estimate of total seabird bycatch mortality in the region, and differs from the sum of the species mortality estimates.



**Figure 5.22**

Seabird bycatch in the Southeast Region ( $n$  = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks. The total ( $n$  = 186.09) is an estimate of total seabird bycatch mortality in the region, and differs from the sum of the species mortality estimates.

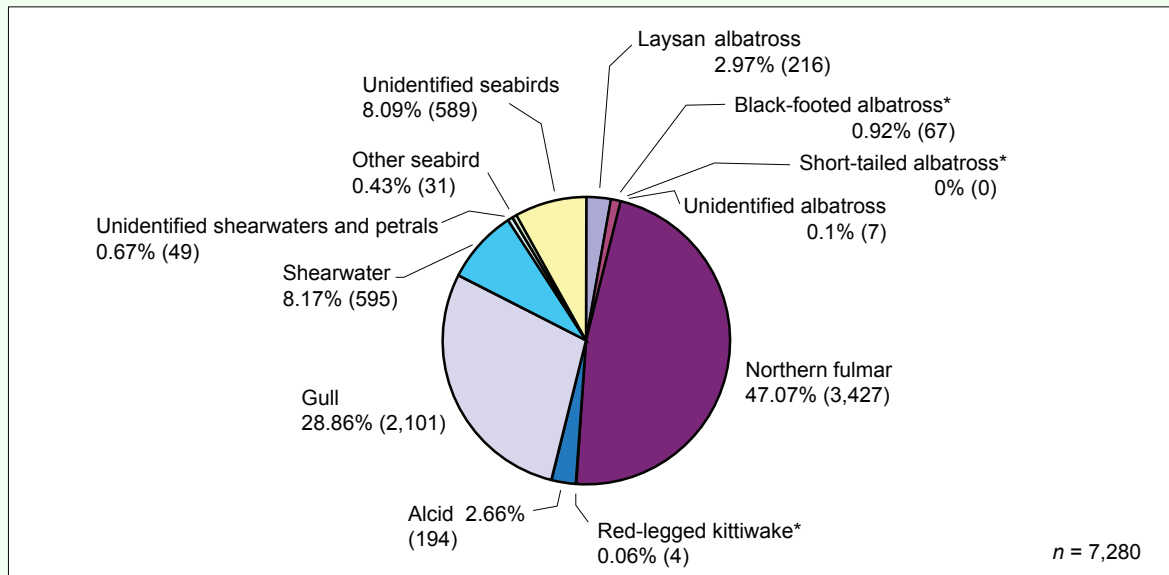


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### 5.6.4.3 Alaska Region Seabird Bycatch

Seabird bycatch estimates were provided for 19 Alaska Region commercial fisheries. For the majority of fisheries, seabird bycatch was comprised of several species. Seabird bycatch estimated for the BSAI pollock pelagic trawl fishery was 322 animals comprised of nine different species; Northern fulmar was the most frequently taken bird species in this fishery (179 animals). The fishery with the highest seabird bycatch estimate was the BSAI Pacific cod longline fishery, with 5,661 seabirds from 11 different populations; most numerous were gulls (1,970 animals) and northern fulmars (2,617).

Seabird bycatch estimates represented 12 populations, with three identified as key stocks (Figure 5.23). The total seabird bycatch estimate for the BSAI and GOA combined was 7,280 seabirds. Most numerous among these were northern fulmar (3,427) and gulls (2,101), neither of which was identified as a key stock. The key stocks represented in the bycatch were black-footed albatross (57) and red-legged kittiwake (4). Short-tailed albatross populations are listed as endangered under the ESA, while black-footed albatross and kittiwake are listed as Birds of Conservation Concern by the USFWS.



**Figure 5.23**

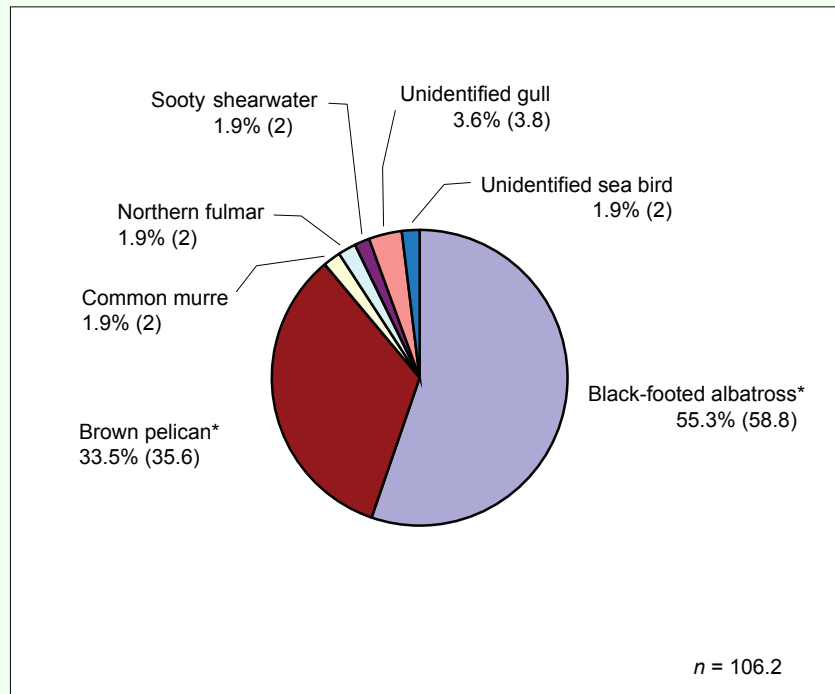
Seabird bycatch in the Alaska Region (*n* = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.

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## 5.6.4.4 Northwest Region Seabird Bycatch

Seabird bycatch estimates were provided for five Northwest Region commercial fisheries. Although bycatch estimates were based on a single year of data (2005), some fractional values were reported due to the estimation process. No seabird bycatch was reported in the California/Oregon nearshore rockfish fishery. Low levels of seabird bycatch were reported for the West Coast groundfish non-trawl limited-entry sablefish-endorsed fixed gear fishery (56 black-footed albatross), the West Coast groundfish non-trawl non-endorsed fixed gear fishery (36 brown pelicans), the West Coast mid-water hake trawl fishery (10 seabirds from five populations), and the West Coast limited-entry groundfish bottom trawl fishery (4 unidentified gulls).

Seabird bycatch estimates were provided for seven populations, with two populations identified as key stocks (Figure 5.24). Total seabird bycatch in the 2005 West Coast fisheries was estimated at 106 animals. Black-footed albatross and brown pelican, considered key stocks, had bycatch estimates of 58.8 and 35.6 animals, respectively. The black-footed albatross is on the USFWS list of Birds of Conservation Concern; under the ESA, it is considered either stable, increasing, or decreasing, because different colonies are experiencing different population trends (Naughton et al. 2008a). The brown pelican was listed as endangered under the ESA, but was delisted in 2009; however, this report shows it as ESA-listed for consistency with the timeframe of the report overall.



**Figure 5.24**

Seabird bycatch in the Northwest Region ( $n$  = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.

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### 5.6.4.5 Southwest Region Seabird Bycatch Estimates

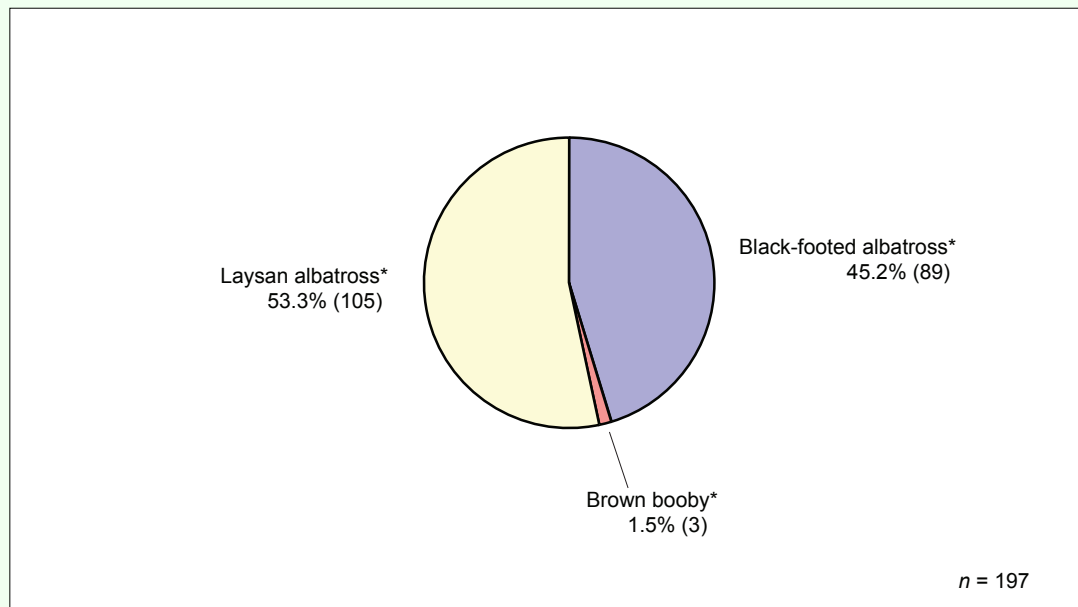
Seabird bycatch estimates were not calculated for Southwest Region commercial fisheries for the period covered by this report. Previous estimates of seabird bycatch for fisheries in this region can be found in journal articles published by the Southwest Region (Julian and Beeson 1998; Carretta et. al. 2005).

### 5.6.4.6 Pacific Islands Region Seabird Bycatch

Seabird bycatch was observed in the Hawaii-based shallow-set pelagic longline fishery (swordfish) and the Hawaii-based deep-set pelagic longline fishery (tuna), with an esti-

mated annual total of 128 seabirds bycaught in the deep-set fishery and 69 seabirds bycaught in the shallow-set fishery. Laysan albatross were the main bycatch in the shallow-set fishery (62 of the 69 animals), while black-footed albatross and Laysan albatross were both bycaught in the deep-set fishery (82 and 43 animals, respectively).

Seabird bycatch estimates were provided for four populations, with all populations identified as key stocks (Figure 5.25). The estimated annual total number of seabirds bycaught in Pacific Islands fisheries was 197 animals. Bycatch estimates were 89 black-footed albatross, 3 brown booby, 105 Laysan albatross, and 0 short-tailed albatross. The stock status for these populations is unknown.



**Figure 5.25**

Seabird bycatch in the Pacific Islands Region ( $n$  = total number of bycaught animals). The baseline year of data used in this report was 2005; however, for some rare-event species multiple years of data were used to generate a bycatch estimate. Stocks for which bycatch estimates were zero are not shown. \* indicates key stocks.

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## 5.7 National and Regional Estimates of Overall Bycatch

Estimated fish bycatch for the U.S. commercial fisheries considered in this report totaled 1.221 B pounds, while associated landings for these fisheries totaled over 6.068 B pounds (Table 5.6). The resulting estimated overall bycatch ratio (defined as the ratio of bycatch to total catch, where total catch equals landings plus bycatch) for fish bycatch in all U.S. commercial fisheries considered in this report is 0.17 (rounded from the calculated ratio of 0.167543); note that calculations in Table 5.7 are based on the true ratio (0.167543). The ratio 0.17 is referred to as the “overall bycatch ratio” in the subsequent discussion. The computation of an overall bycatch ratio did not include bycatch of protected species; for fisheries considered in this report, total estimated bycatch of marine mammals was 1,887 individual animals, of sea turtles was 11,772 animals, and of seabirds was 7,769 animals.

In some fisheries, insufficient data were available for analysis. For other fisheries, analytical methods for estimating some types of bycatch were not available when the report was compiled (e.g., bycatch estimates were not provided for fish species in the Southwest Region or for seabirds in the Northeast and Southwest Regions). In addition, fish bycatch estimates were provided in numbers of individuals for some Southeast and Northwest Region fisheries, and these

estimates were not included in the calculation of total U.S. bycatch, because factors for converting numbers to weights were not available.

Table 5.7 provides estimates of overall regional and national fish bycatch (i.e., bycatch associated with all U.S. fisheries including those considered in this report and summarized in Table 5.6 and those not considered in this report). For each region, the overall bycatch ratio (0.167543) was applied to the total landings for those fisheries not considered in the U.S. National Bycatch Report to compute an estimate of fish bycatch (i.e., unknown bycatch was calculated using the bycatch ratio for known bycatch and landings). Computation employed the formula  $\text{bycatch} = (0.167543356 \times \text{Landings}) / (1 - 0.167543)$ , where 0.167543 is the overall bycatch ratio described above. This provided a basis for estimating total bycatch for each region, and the resulting bycatch estimates were summed to provide an overall national bycatch estimate of 1.934 B pounds (Table 5.7).

Bycatch ratios for U.S. commercial fisheries published by the FAO (Kelleher 2004) and Harrington et al. (2005) for the period 2002–2003 were higher than the estimate calculated herein, which is based on 2005 data (Table 5.8). Correspondingly, the overall total bycatch estimate provided in this report is lower than those reported by FAO (Kelleher 2004; 2.045 B pounds) and Harrington et al. (2005; 2.333 B pounds). These reports obtained bycatch estimates and as-

**Table 5.6**

Estimated total fisheries landings and bycatch, by type and region, for fisheries considered in the U.S. National Bycatch Report. Data are generally from 2005, except for some rare-event species estimates for which bycatch data are averaged over a number of years. Weights were rounded to the nearest thousand pounds.

| Region                 | Fish bycatch (lb) | Fish landings (lb) | Marine mammal bycatch (individuals) | Sea turtle bycatch (individuals) | Seabird bycatch (individuals) |
|------------------------|-------------------|--------------------|-------------------------------------|----------------------------------|-------------------------------|
| Northeast              | 165,888,000       | 1,006,370,000      | 1,287                               | 1,062                            | Not available                 |
| Southeast              | 682,691,000       | 219,086,000        | 233                                 | 10,671 <sup>a</sup>              | 186                           |
| Alaska                 | 338,573,000       | 4,487,167,000      | 62                                  | 0 <sup>b</sup>                   | 7,280                         |
| Northwest              | 25,564,000        | 332,396,000        | 37                                  | 0 <sup>b</sup>                   | 106                           |
| Southwest <sup>c</sup> | —                 | —                  | 242                                 | 1                                | Not available                 |
| Pacific Islands        | 8,556,000         | 23,000,000         | 26                                  | 38                               | 197                           |
| TOTALS                 | 1,221,272,000     | 6,068,019,000      | 1,887                               | 11,772                           | 7,769                         |

<sup>a</sup> Bycatch mortality estimates from the NMFS 2002 Biological Opinion on the Shrimp Fisheries of the Southeastern United States. Since that time, effort in the shrimp fishery, and associated bycatch, has decreased markedly.

<sup>b</sup> Sea turtle bycatch has not been observed in Alaska or the Northwest Region.

<sup>c</sup> Southwest region landings are not included, since fish bycatch estimates from the region were not available.



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**Table 5.7**  
Regional and national fish bycatch and ratio estimates for all U.S. commercial fisheries.

| Region          | 2005 landings (lb)                                       |  |               |                             | 2005 bycatch (lb)  |  |  |               |
|-----------------|--|--|---------------|-----------------------------|--|--|--|---------------|
|                 | Fisheries considered in the U.S. National Bycatch Report | Fisheries not considered in the U.S. National Bycatch Report | Total         | % of total landings sampled | Fisheries considered in the U.S. National Bycatch Report | Regional bycatch Ratios <sup>a,b</sup> | Fisheries not considered in the U.S. National Bycatch Report | Total         |
| Northeast       | 1,006,370,000  | 385,816,000  | 1,392,186,000 | 0.72                        | 165,888,000  | 0.14                                   | 77,651,000   | 243,539,000   |
| Southeast       | 219,086,000  | 1,093,033,000  | 1,312,119,000 | 0.17                        | 682,691,000  | 0.76                                   | 219,987,000  | 902,678,000   |
| Alaska          | 4,487,167,000  | 1,164,140,000  | 5,651,307,000 | 0.79                        | 338,573,000  | 0.07                                   | 234,299,000  | 572,872,000   |
| Northwest       | 332,396,000  | 523,464,000  | 855,860,000   | 0.39                        | 25,564,000   | 0.07                                   | 105,354,000  | 130,918,000   |
| Southwest       | —  | 367,830,000  | 367,830,000   | 0.00                        | —  | —                                      | 74,031,000   | 74,031,000    |
| Pacific Islands | 23,000,000   | 9,244,000  | 32,244,000    | 0.71                        | 8,556,000  | 0.27                                   | 1,860,000  | 10,416,000    |
| National Total  | 6,068,019,000  | 3,543,527,000  | 9,611,546,000 | 0.63                        | 1,221,272,000  | 0.17                                   | 713,182,000  | 1,934,454,000 |

<sup>a</sup> Regional bycatch ratios include only fisheries considered in the U.S. National Bycatch Report.

<sup>b</sup> The formula for the bycatch ratios used in this report is bycatch / (bycatch + landings).

sociated landings data from published and grey literature, while the estimates used here are based on raw data, as well as data obtained from a range of published and unpublished reports. In addition, FAO (2002) reports that their database may be biased in favor of fisheries with high discards and this would result in an overall overestimate of bycatch. This type of positive bias is also likely for the Harrington et al. (2005) report, which also included a subset of fisheries.

Since both reports drew information from a smaller sub-

set of fisheries than this report and, apparently, were more likely to include information on fisheries with noteworthy bycatch concerns, higher overall bycatch rate estimates might be expected. Since this report is more comprehensive, the bycatch ratio estimate in this report should be considered to be the best estimate currently available. It is apparent that the authors of the FAO (Kelleher 2004) and Harrington et al. (2005) reports encountered considerable difficulty in obtaining comprehensive and accurate catch and bycatch data and found it necessary to make extrapolations based on a range of assumptions. This report, while more inclusive,

**Table 5.8**  
Comparison of fish bycatch estimates for U.S. commercial fisheries from the National Bycatch Report with previously published estimates. Bycatch ratios are calculated as the total bycatch divided by the total catch (bycatch plus landings).

| Reference                           | Year of source data | Total bycatch estimate (lb) | Total landings (lb) | Bycatch ratio |
|-------------------------------------|---------------------|-----------------------------|---------------------|---------------|
| U.S. National Bycatch Report (2011) | 2005                | 1,934,454,000               | 9,611,546,000       | 0.17          |
| FAO (Kelleher 2004)*                | 2002                | 2,045,006,000*              | 7,373,224,000*      | 0.22          |
| Harrington et al (2005)             | 2002–03             | 2,332,894,000*              | 8,194,516,000*      | 0.22          |

\* Converted from metric tons.

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also required extrapolation of estimates for many fisheries and species due to data limitations. This serves to emphasize the need for reporting of accurate and comprehensive information of the type presented here, and the importance of updating this report frequently and expanding its scope as information on additional U.S. fisheries becomes available.

Bycatch estimates for marine mammals, sea turtles, and seabirds were recently reported by Moore et al. (2009), which provided an overall national estimate for marine mammals only. The estimate of national marine mammal mortality by Moore et al. (2009) was 3,029–3,187 animals annually for the period 1990–99, while our estimate is 1,887 animals annually (using 2005 data, although some were for a range of years). Because the data presented in Moore et al. (2009) are based on averages across a time-frame ear-

lier than that utilized in this report, a direct comparison with estimates presented herein is not possible. In a broad comparison, the U.S. National Bycatch Report contains lower bycatch estimates, but this report does not speculate as to the reasons that the estimates are different.

## 5.8 Improving Bycatch Data Collection and Estimation

This report identifies national and regional recommendations to improve bycatch data collection and estimation (summarized in Table 5.9). Maintenance and expansion of existing observer programs and implementation of new observer programs for fisheries and species with bycatch concerns are of particular importance. Funding levels for

**Table 5.9**  
Resources needed to implement recommendations for improving bycatch data collection and estimation. Details are provided in Appendix 5.

| Recommendation <sup>a</sup>   | National Observer Program | Northeast           | Southeast | Alaska         | Northwest | Southwest | Pacific Islands | Total  |
|---|---------------------------|---------------------|-----------|----------------|-----------|-----------|-----------------|--------|
| Days at sea (DAS) <sup>b</sup> needed to maintain current observer programs         | na                        | 13,208              | 4,085     | 39,000         | 4,596     | 329       | 9,739           | 70,957 |
| DAS needed to expand current observer programs                                      | na                        | 16,181 <sup>e</sup> | 11,790    | 29,160         | 792       | 430       | 855             | 59,209 |
| DAS needed to implement new observer programs                                       | na                        | 615                 | 5,752     | 0 <sup>f</sup> | 1,058     | 20        | 0               | 7,425  |
| Full-time staff needed to implement improvements to estimation methods <sup>c</sup> | 10 <sup>d</sup>           | 17                  | 7         | 13             | 1         | 1         | 6               | 55     |

<sup>a</sup> Some recommendations may require additional resources such as equipment or staff support, which are not itemized.

<sup>b</sup> DAS estimates for maintaining and expanding current observer programs are based on 2008 figures.

<sup>c</sup> Observer program staffing and administrative needs are included when budgeting the cost for DAS and are not included in this table.

<sup>d</sup> Staffing support would not be directly for the National Observer Program, but would be used to assist with implementation of national recommendations.

<sup>e</sup> DAS estimate for the Northeast includes both fish and protected species needs; in some cases, DAS could be shared, and thus the overall number of DAS would be reduced.

<sup>f</sup> For the Alaska Region, much of the increased coverage would be applied to fisheries and vessels that have not previously been observed.

all existing regional observer programs, as of 2008, totaled \$53.1 M (Federal and industry funds). Many specific recommendations are made here to improve observer program data, supplemental data, and analytical techniques within each region; these recommendations are summarized here, and are presented in detail in the regional sections of Section 4. It was not possible to prioritize individual recommendations among regions due to the diversity in fisheries, management needs, and other factors. Eight national-level recommendations are provided below. These focus on improving data and estimation quality for fisheries and species considered in this edition of the U.S. National Bycatch Report, and on considering additional fisheries and species in future editions of the report. All recommendations should be considered to have high priority, although some could be implemented relatively quickly and inexpensively while others would require considerable investment of time and financial resources. As more fisheries and species are evaluated and reported, it is likely that additional resource needs will be identified.

## **Recommendation #1:**

### **Develop and adopt best practices for estimating bycatch in U.S. commercial fisheries.**

Methods for estimating bycatch vary by region and fishery. While all methods have been subjected to some level of review, many have not been formally peer reviewed. Further work to evaluate and improve current methods and to develop new approaches will lead to establishment of best practices, including procedures for estimation of variance and methods for extrapolating estimates from small sample sizes. Where numbers-based methods are currently employed, weight-based approaches should be developed and implemented. Improving the quantity and quality of bycatch estimates is essential to support the information needs for management of commercial fisheries and protected resources. Provision of measures of uncertainty associated with bycatch estimates is important for tracking improvements in estimation methods and bycatch trends.

## **Recommendation #2:**

### **Improve national and regional catch databases.**

Estimation of bycatch rates requires reliable information on total catch at the stock level. Inconsistencies between regional and national databases impeded estimation of stock bycatch ratios in a number of instances. Overall database improvements are necessary to resolve this problem. These types of improvements will enhance both quality and timelines of bycatch estimates, as well as consistency of estimates made by different researchers.

## **Recommendation #3:**

### **Review and modify the tier classification system for application to commercial and recreational fisheries included in future editions of the U.S. National Bycatch Report.**

Future editions of the U.S. National Bycatch Report should include bycatch estimates for additional commercial and recreational fisheries. The tier classification system developed in this report should be modified as necessary and applied to additional fisheries where possible. Coordination will be required with state, tribal, and international organizations to ensure accuracy and consistency. In order to maximize the usefulness of the tier system for tracking change and highlighting requirements for improvement, it will need to be as comprehensive as possible.

## **Recommendation #4:**

### **Increase the number of fishery and species bycatch estimates included in future editions of the U.S. National Bycatch Report.**

- **Commercial Fisheries Bycatch Estimates:** Efforts should be taken to develop bycatch estimates for all commercial fisheries where the necessary data are available. These estimates should be included in future editions of the U.S. National Bycatch Report. In the longer term, new data-collection programs should be implemented to address bycatch estimation information needs for those commercial fisheries identified as requiring bycatch monitoring.
- **Recreational Fisheries Bycatch Estimates:** Inclusion of recreational bycatch estimates is necessary to estimate overall bycatch mortality for some stocks. Development of appropriate bycatch data-collection and analytical methods should be encouraged and supported.
- **Bycatch Estimates for Key Stocks:** Lack of bycatch estimates for some of the key stocks identified in this report is of particular concern. Development of bycatch estimates for these stocks should be prioritized and should be included in future editions of the U.S. National Bycatch Report.

Providing additional stock- and fishery-specific bycatch estimates in future editions of the U.S. National Bycatch Report will provide new information to the public on the overall status of bycatch in the Nation's fisheries. Scientists and managers will be able to make use of this information for assessment and management, for evaluating the effectiveness of bycatch reduction measures, and for identifying areas where improved management and/or innovative bycatch reduction methods are required.

## **Recommendation #5:**

**Implement specific bycatch data-collection and estimation improvements in regional programs.**

Several recommendations were made for improvement of bycatch data collection and estimation within the regions. These include discard mortality studies; outreach; database infrastructure improvements; and collection and processing of supplemental data, especially logbooks, VMS, and strandings and entanglement data, which are often essential for estimating bycatch. These types of data are required in many bycatch estimation approaches and are often lacking or of poor quality. Thus these types of improvements will result in overall improvements in bycatch data quality and the number of fisheries and stocks for which bycatch estimates are available.

## **Recommendation #6:**

**Maintain and expand existing regional observer programs.**

Observer programs have been implemented in all NMFS regions; observer data are considered to be the most reliable basis for bycatch estimation. Many U.S. observer programs are at suboptimal coverage levels, which vary depending on the characteristics of a fishery and the species of interest. Specific recommendations for maintaining and expanding observer coverage to optimal levels in existing programs are made in the regional sections. Maintenance of these programs is essential for ongoing estimation of bycatch and evaluation of mitigation measures. Expanding coverage of existing observer programs will improve the accuracy and precision of bycatch estimates in many instances.

## **Recommendation #7:**

**Implement new observer programs for fisheries and species with bycatch concerns.**

New observer programs are recommended in most regions for a total of 32 fisheries. These fisheries were identified as fisheries of focus, as described in Section 3 (e.g. fisheries with a high bycatch ratio, bycatch of key stocks, or that were identified through the qualitative process). Pilot observer coverage has been recommended by the applicable regional team as an initial step address bycatch concerns in several instances. Recommendations for new observer programs also include electronic monitoring in some regions. Implementing new pilot observer programs will provide information on bycatch in fisheries where bycatch information is currently unavailable or available only in the form of unverified industry reports.

## **Recommendation #8:**

**Evaluate electronic monitoring systems, conduct pilot studies, and operationalize electronic monitoring technology where appropriate.**

Use of video cameras and other electronic data acquisition systems (collectively termed electronic monitoring or EM) has increased markedly during the last decade. Electronic monitoring has been used successfully for compliance monitoring and verification of self-reporting, and can provide useful information on catch quantity and composition, although species identification is only possible in some instances. The approach holds promise for addressing certain types of objectives (e.g., monitoring for compliance with discard prohibitions) and should be able to provide more detailed information on catch and bycatch composition as the technologies advance.

## **5.9 Conclusions**

The recommendations included in this report provide guidance to the Agency in setting priorities for maintaining existing bycatch data-collection programs, expanding programs where more reliable bycatch information is needed, and implementing new bycatch data-collection programs for fisheries with potential bycatch concerns. Implementation of these recommendations will assist NMFS in increasing baseline knowledge of bycatch levels, help identify fisheries and/or stocks with potential bycatch concerns, and improve the monitoring of bycatch levels over time. Improved bycatch estimates will support the implementation of MSA-required annual catch limits (ACLs) and new management approaches such as catch-share programs, and in general will aid the NMFS in addressing fishery-specific conservation and management concerns.

Two performance measures have been developed from the information compiled in this report: 1) the tier classification system, which will be used to monitor the quality of bycatch estimates in U.S. commercial fisheries, and 2) a list of key stocks, which will be used to monitor bycatch trends over time. These performance measures will assist NMFS in continuing to improve the effectiveness of bycatch monitoring programs, as well as reducing bycatch in key fisheries.

This is the first in a series of U.S. National Bycatch Reports. This edition contains bycatch estimates for federally managed commercial fisheries or with relevant Federal data-collection programs. Future editions will include timely and period updates on bycatch estimates for Federal fisheries, as well as estimates for state, international, and tribal fisheries where data are available. Inclusion of bycatch estimates

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for stocks with high recreational bycatch mortality will also be considered. Over time, the U.S. National Bycatch Report will provide NMFS, other fisheries management organizations, and the public with reliable bycatch estimates for all living marine resources which can be used to more effectively meet NMFS' stewardship mission.



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## Appendix 5.A Recommendations for Improvement.

Recommendations by region for improving bycatch data-collection and estimation methods, including estimates of observer DAS and feasibility of implementation. Requirements for maintaining existing programs are not listed for individual fisheries, but are listed as a total cost for each region (\*\*). Recommendations in this table are summarized from information contained in the regional sections; please refer to Sections 4.1–4.6 for detailed information on the DAS and feasibility, as well as rationale, for each recommendation included herein.

| REGION                         | FISHERY                        | RECOMMENDATION   | DAS | FEASIBILITY |
|--------------------------------|--------------------------------|--|-----|-------------|
| <b>General Recommendations</b> |                                |  |     |             |
| National                       | All Fisheries                  | The NMFS should continue internal review of regional bycatch estimation methods and evaluate the potential development and adoption of a national standardized method for estimating bycatch in U.S. commercial fisheries. | NA  | High        |
| National                       | All Fisheries                  | The tier classification system should be applied to all fisheries included in future editions of the U.S. National Bycatch Report, including state, tribal, and international fisheries.                                   | NA  | Medium      |
| National                       | All Fisheries                  | A modified tier classification system should be developed to evaluate recreational fishery bycatch estimates.  | NA  | High        |
| National                       | All Fisheries                  | Bycatch estimates should be provided in future editions of the U.S. National Bycatch Report for all key stocks, to allow for monitoring of bycatch trends over time at both the regional and national levels.              | NA  | High        |
| National                       | All Fisheries                  | Fishery bycatch estimates should be calculated for additional U.S. commercial fisheries.   | NA  | Medium      |
| National                       | All Fisheries                  | Where fishery bycatch estimates are calculated in numbers of fish, conversion factors to pounds should be developed or bycatch data should be collected in pounds of fish.   | NA  | High        |
| National                       | All Fisheries                  | Improvements should be made in the collection of total catch figures by individual species, to allow calculation of stock bycatch ratios.  | NA  | High        |
| Northeast                      | All Fisheries                  | Initiate study of discard mortality (via special studies, study fleets, etc.) for multiple fisheries.  | NA  | High        |
| Northeast                      | All Fisheries                  | Improve database infrastructure for multiple fisheries.  | NA  | High        |
| Northeast                      | All Fisheries                  | Implement Serious Injury Protocol for determining serious injuries, and update observer program data-collection forms (protected species).   | NA  | High        |
| Northeast                      | All Fisheries                  | Conduct assessment of needs for seabird bycatch data collection and estimation (protected species).  | NA  | High        |
| Northeast                      | Mid-Atlantic Gillnet Fisheries | Informational mailing to gillnetters using vessel trip report forms (protected species).   | NA  | High        |

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**Appendix Table 5.A** (continued)

| REGION   | FISHERY  | RECOMMENDATION  | DAS   | FEASIBILITY |
|--|--|---|-------|-------------|
| <b>General Recommendations (cont.)</b>               |  |   |       |             |
| Northeast  | New England Gillnet Fisheries  | Informational mailings for all fisheries in New England gillnet fisheries using vessel trip report forms (protected species).                           | NA    | High        |
| Southeast  | Southeastern Atlantic and Gulf of Mexico Shark Bottom Longline Fishery | Instruct Southeastern Atlantic and Gulf of Mexico shark bottom longline fishers to report to one logbook.   | NA    | Low         |
| <b>Observer Coverage</b>                             |  |   |       |             |
| <b>Maintain and Expand Current Observer Coverage</b> |  |   |       |             |
| Northeast  | Mid-Atlantic Scallop Dredge Fisheries                                  | Maintain current observer program coverage levels in the Mid-Atlantic general category open-area scallop dredge fishery.                                | **    | High        |
| Northeast  | Mid-Atlantic Scallop Dredge Fisheries                                  | Maintain current observer program coverage levels in the Mid-Atlantic limited-access closed-area scallop dredge fishery.                                | **    | High        |
| Northeast  | Mid-Atlantic Scallop Dredge Fisheries                                  | Maintain current observer program coverage levels in the Mid-Atlantic limited-access open-area scallop dredge fishery.                                  | **    | High        |
| Northeast  | Mid-Atlantic Scallop Trawl Fisheries                                   | Maintain current observer program coverage levels in the Mid-Atlantic general category scallop trawl fishery.   | **    | High        |
| Northeast  | New England Bottom Longline Fisheries                                  | Maintain current observer program coverage levels in the New England bottom longline fishery.   | **    | High        |
| Northeast  | New England Bottom Longline Fisheries                                  | Maintain current observer program coverage levels in the New England haddock sector longline.   | **    | High        |
| Northeast  | New England Gillnet Fisheries  | Maintain current observer program coverage levels for the New England extra-large-mesh gillnet fishery.   | **    | High        |
| Northeast  | New England Gillnet Fisheries  | Maintain current observer program coverage levels for the New England large-mesh gillnet fishery.   | **    | High        |
| Northeast  | New England Otter Trawl Fisheries                                      | Maintain current observer program coverage levels in the New England large-mesh otter trawl fishery.  | **    | High        |
| Northeast  | New England Otter Trawl Fisheries                                      | Maintain current observer program coverage levels in the New England B REG DAS large mesh otter trawl fishery.  | **    | High        |
| Northeast  | New England Otter Trawl Fisheries                                      | Maintain current observer program coverage levels in the New England US/CAN area large-mesh otter trawl fishery.  | **    | High        |
| Northeast  | New England Otter Trawl Fisheries                                      | Maintain current observer program coverage levels in the New England US/CAN area small-mesh otter trawl fishery.  | **    | High        |
| Northeast  | New England Otter Trawl Fisheries                                      | Increase observer coverage in the New England small-mesh otter trawl fishery.   | 1,562 | High        |
| Northeast  | New England Scallop Dredge Fisheries                                   | Maintain current observer program coverage levels but improve temporal coverage in the New England general category closed-area scallop dredge fishery. | **    | High        |

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**Appendix Table 5.A** (continued)

| REGION   | FISHERY                                     | RECOMMENDATION  | DAS    | FEASIBILITY |
|--|---|---|--------|-------------|
| <b>Observer Coverage</b>                                     |   |   |        |             |
| <b>Maintain and Expand Current Observer Coverage (cont.)</b> |   |   |        |             |
| Northeast  | New England Scallop Dredge Fisheries        | Maintain current observer program coverage levels in the New England limited-access closed-area scallop dredge fishery.               | **     | High        |
| Northeast  | New England Scallop Dredge Fisheries        | Increase observer coverage in the New England limited-access open area scallop dredge fishery.  | 91     | High        |
| Northeast  | Mid-Atlantic Gillnet Fisheries              | Increase observer coverage of the Mid-Atlantic extra-large-mesh gillnet fishery to obtain pilot coverage.                             | 20     | High        |
| Northeast  | Mid-Atlantic Gillnet Fisheries              | Increase observer coverage to achieve 30% uncertainty <sup>a</sup> across all Mid-Atlantic gillnet fisheries (protected species).     | 500    | High        |
| Northeast  | Mid-Atlantic Otter Trawl Fisheries          | Increase observer coverage in the Mid-Atlantic large-mesh otter trawl fishery .   | 342    | High        |
| Northeast  | Mid-Atlantic Otter Trawl Fisheries          | Increase observer coverage in the Mid-Atlantic small-mesh otter trawl fishery.  | 659    | High        |
| Northeast  | Mid-Atlantic Otter Trawl Fisheries          | Increase observer coverage to achieve 30% uncertainty <sup>a</sup> across all Mid-Atlantic otter trawl fisheries (protected species). | 500    | High        |
| Northeast  | New England Gillnet Fisheries               | Increase observer coverage to achieve 30% CV across all New England gillnet fisheries (protected species).                            | 600    | High        |
| Northeast  | Mid-Atlantic Mid-Water Paired Trawl Fishery | Deploy an additional observer for all paired-trawl trips in the Mid-Atlantic mid-water paired trawl fishery.                          | NA     | High        |
| Northeast  | Mid-Atlantic Mid-Water Otter Trawl Fishery  | Increase observer coverage in the Mid-Atlantic mid-water otter trawl fishery.   | 512    | High        |
| Northeast  | New England Handline Fishery                | Increase observer coverage in the New England handline fishery to obtain pilot coverage.  | 110    | High        |
| Northeast  | New England Purse Seine Fishery             | Maintain current observer program coverage levels in the New England purse seine fishery.   | **     | High        |
| Northeast  | New England Mid-Water Otter Trawl Fishery   | Increase observer coverage in the New England mid-water otter trawl.  | 35     | High        |
| Northeast  | New England Shrimp Trawl Fishery            | Maintain current observer program coverage levels but improve temporal coverage in the New England shrimp trawl fishery.              | **     | High        |
| Northeast  | New England Otter Trawl Fisheries           | Increase observer coverage to achieve 30% uncertainty <sup>a</sup> across all New England otter trawl fisheries (protected species).  | 10,000 | Moderate    |
| Northeast  | Mid-Atlantic Gillnet Fisheries              | Expand number of fishing effort variables collected by states across all Mid-Atlantic gillnet fisheries.                              | NA     | Low         |
| Northeast  | New England Single Mid-Water Trawl Fishery  | Increase observer coverage of the New England single mid-water trawl fishery (protected species).                                     | 1,250  | Moderate    |

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**Appendix Table 5.A** (continued)

| REGION   | FISHERY   | RECOMMENDATION   | DAS     | FEASIBILITY |
|--|---|--|---------|-------------|
| <b>Observer Coverage</b>   |   |  |         |             |
| <b>Maintain and Expand Current Observer Coverage (cont.)</b>                   |   |  |         |             |
| Northeast  | Mid-Atlantic Otter Trawl Fisheries                                    | Direct observer coverage to areas of suspected high sea turtle bycatch.  | Unknown | Unknown     |
| TOTAL NORTHEAST TO MAINTAIN CURRENT OBSERVER COVERAGE <sup>b</sup>             |   |  | 13,208  |             |
| TOTAL NORTHEAST TO EXPAND CURRENT OBSERVER COVERAGE                            |   |  | 16,181  |             |
| TOTAL NORTHEAST TO MAINTAIN AND EXPAND CURRENT OBSERVER COVERAGE <sup>b</sup>  |   |  | 29,389  |             |
| Southeast  | Gulf of Mexico Reef Fish Bottom Longline Fishery                      | Maintain and refine observer program, including determination of needed sample size to achieve 30% uncertainty <sup>a</sup> for the ten most commonly discarded species, for the Gulf of Mexico reef fish bottom longline fishery. | 1,667   | High        |
| Southeast  | Gulf of Mexico Shrimp Trawl Fishery                                   | Maintain and refine current Gulf of Mexico shrimp trawl observer program.  | 5,000   | High        |
| Southeast  | Large Coastal and Small Coastal Shark Aggregate Fishery               | Increase observer coverage for the large coastal and small coastal shark aggregate (drift, strike, and bottom gillnet) fishery.  | 540     | High        |
| Southeast  | North Carolina Inshore Gillnet Fishery                                | Expand North Carolina inshore (bays and rivers) gillnet observer program to cover any additional open components of the fishery.   | 250     | High        |
| Southeast  | Southeastern Atlantic Shrimp Trawl Fishery                            | Maintain and refine current Southeastern Atlantic shrimp trawl observer program.   | 833     | High        |
| Southeast  | Southeastern Atlantic and Gulf of Mexico HMS Pelagic Longline Fishery | Increase observer coverage for the Southeastern Atlantic and Gulf of Mexico HMS pelagic longline fishery to achieve 30% uncertainty <sup>a</sup> in all strata.  | 3,500   | Moderate    |
| TOTAL SOUTHEAST TO MAINTAIN CURRENT OBSERVER COVERAGE <sup>b</sup>             |   |  | 4,085   |             |
| TOTAL SOUTHEAST TO EXPAND CURRENT OBSERVER COVERAGE                            |   |  | 11,790  |             |
| TOTAL SOUTHEAST TO MAINTAIN AND EXPAND CURRENT OBSERVER COVERAGE <sup>b</sup>  |   |  | 15,875  |             |
| Alaska   | Multiple Fisheries  | Maintain current levels for currently observed fisheries.  | **      | High        |
| Alaska   | Multiple Fisheries  | Observer program operations and administration adjustment.   | NA      | High        |
| Alaska   | Multiple Fisheries  | Increase coverage for sector observed at 30% and implement coverage for unobserved sectors (<60 feet, Pacific halibut fishery).  | 20,000  | High        |
| Alaska   | Multiple Fisheries  | Improve length of AMMOP observation cycle from 14 to 5 years.  | 9,160   | High        |
| Alaska   | Multiple Fisheries  | Hire 3 to 5 FTEs to support AMMOP.   | NA      | High        |
| TOTAL ALASKA TO MAINTAIN CURRENT OBSERVER COVERAGE <sup>b,c</sup>              |   |  | 39,000  |             |
| TOTAL ALASKA TO EXPAND CURRENT OBSERVER COVERAGE <sup>d</sup>                  |   |  | 29,160  |             |
| TOTAL ALASKA TO MAINTAIN AND EXPAND CURRENT OBSERVER COVERAGE <sup>b,c,d</sup> |   |  | 68,160  |             |

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**Appendix Table 5.A** (continued)

| REGION  | FISHERY   | RECOMMENDATION  | DAS     | FEASIBILITY |
|---|---|---|---------|-------------|
| <b>Observer Coverage</b>  |   |   |         |             |
| <b>Maintain and Expand Current Observer Coverage (cont.)</b>                        |   |   |         |             |
| Northwest   | Multiple Fisheries  | Maintain current levels for currently observed fisheries.   | **      | High        |
| Northwest   | West Coast Groundfish Non-Trawl Gear, Non-Endorsed Fixed Gear       | Increase observer coverage for West Coast groundfish non-trawl gear, non-endorsed fixed gear.   | 167     | High        |
| Northwest   | CA/OR Nearshore Rockfish Fishery                                    | Increase observer coverage of the California/Oregon nearshore rockfish fishery.   | 625     | High        |
| TOTAL NORTHWEST TO MAINTAIN CURRENT OBSERVER COVERAGE <sup>b,c</sup>                |   |   | 4,596   |             |
| TOTAL NORTHWEST TO EXPAND CURRENT OBSERVER COVERAGE <sup>d</sup>                    |   |   | 792     |             |
| TOTAL NORTHWEST TO MAINTAIN AND EXPAND CURRENT OBSERVER COVERAGE <sup>b,c,d</sup>   |   |   | 5,388   |             |
| Southwest   | California Coastal Purse Seine Fishery (anchovy, mackerel, sardine) | Increase observer coverage of the California coastal purse seine for anchovy, mackerel, and sardine fishery to 10%.                             | 50      | High        |
| Southwest   | California Coastal Purse Seine Fishery (tuna)                       | Increase observer coverage of the California coastal purse seine fishery for tuna to 100%.  | 20      | High        |
| Southwest   | California Coastal Purse Seine Fishery (squid)                      | Increase observer coverage of the California coastal purse seine fishery for squid to at least 10% of all sets.                                 | 110     | High        |
| Southwest   | California Small-Mesh Drift Gillnet Fishery                         | Increase observer coverage of the California small-mesh drift gillnet (mesh size >3.5 inches and < 14 inches) to 20%.                           | 20      | High        |
| Southwest   | California/Oregon Drift Gillnet Fishery                             | Increase observer coverage of the California/Oregon drift gillnet (mesh size >14 inches) fishery targeting swordfish and thresher shark to 30%. | 130     | Moderate    |
| Southwest   | California Set Gillnet Fishery                                      | Increase observer coverage of the California set gillnet (mesh size up to 14 inches) to 20%.  | 100     | Moderate    |
| TOTAL SOUTHWEST TO MAINTAIN CURRENT OBSERVER COVERAGE <sup>b</sup>                  |   |   | 329     |             |
| TOTAL SOUTHWEST TO EXPAND CURRENT OBSERVER COVERAGE                                 |   |   | 430     |             |
| TOTAL SOUTHWEST TO MAINTAIN AND EXPAND CURRENT OBSERVER COVERAGE <sup>b</sup>       |   |   | 759     |             |
| Pacific Islands   | Hawaii Deep- and Shallow-Set Pelagic Longline Fisheries             | Maintain current observer program coverage levels for the Hawaii deep- and shallow-set pelagic longline fisheries.                              | **      | High        |
| Pacific Islands   | American Samoa Pelagic Longline Fishery                             | Increase observer program coverage levels for the American Samoa pelagic longline fishery to 40%.   | 855     | High        |
| TOTAL PACIFIC ISLANDS TO MAINTAIN CURRENT OBSERVER COVERAGE <sup>b</sup>            |   |   | 9,739   |             |
| TOTAL PACIFIC ISLANDS TO EXPAND CURRENT OBSERVER COVERAGE                           |   |   | 855     |             |
| TOTAL PACIFIC ISLANDS TO MAINTAIN AND EXPAND CURRENT OBSERVER COVERAGE <sup>b</sup> |   |   | 10,594  |             |
| NATIONAL TOTAL TO MAINTAIN CURRENT OBSERVER COVERAGE <sup>b,c,d</sup>               |   |   | 70,957  |             |
| NATIONAL TOTAL TO EXPAND CURRENT OBSERVER COVERAGE <sup>d</sup>                     |   |   | 59,208  |             |
| NATIONAL TOTAL TO MAINTAIN AND EXPAND CURRENT OBSERVER COVERAGE <sup>b,c,d</sup>    |   |   | 130,165 |             |



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**Appendix Table 5.A** (continued)

| REGION   | FISHERY                                 | RECOMMENDATION  | DAS     | FEASIBILITY |
|--|---|---|---------|-------------|
| <b>Observer Coverage<br/>Implement New Observer Programs</b> |   |   |         |             |
| Northeast  | Mid-Atlantic Scallop Dredge Fisheries   | Implement pilot observer coverage for the Mid-Atlantic general category closed-area scallop dredge fishery. | 12      | High        |
| Northeast  | New England Scallop Dredge Fisheries    | Implement pilot observer coverage in the New England general category open-area scallop dredge fishery.     | 127     | High        |
| Northeast  | Mid-Atlantic Gillnet Fisheries          | Implement pilot observer program for the Mid-Atlantic large-mesh gillnet fishery.                           | 91      | High        |
| Northeast  | New England Gillnet Fisheries           | Implement pilot observer coverage for the New England small-mesh gillnet fishery.                           | 12      | High        |
| Northeast  | Mid-Atlantic Gillnet Fisheries          | Implement pilot observer program for the Mid-Atlantic small-mesh gillnet fishery.                           | 15      | High        |
| Northeast  | Mid-Atlantic Bottom Longline Fishery    | Implement pilot observer coverage for the Mid-Atlantic bottom longline fishery.                             | 19      | High        |
| Northeast  | Mid-Atlantic Crab Pot Fishery           | Implement pilot observer coverage for Mid-Atlantic crab pots.   | 12      | High        |
| Northeast  | Mid-Atlantic Clam/Quahog Dredge Fishery | Implement pilot observer coverage for the Mid-Atlantic clam/quahog dredge fishery.                          | 21      | High        |
| Northeast  | Mid-Atlantic Fish Pots/Traps Fishery    | Implement pilot observer coverage for Mid-Atlantic fish pots/traps.   | 20      | High        |
| Northeast  | Mid-Atlantic Atlantic Handline Fishery  | Implement pilot observer coverage in the Mid-Atlantic handline fishery.                                     | 33      | High        |
| Northeast  | Mid-Atlantic Lobster Pots               | Implement pilot observer coverage for the Mid-Atlantic lobster pot fishery.                                 | 22      | High        |
| Northeast  | Mid-Atlantic Purse Seine Fishery        | Implement pilot observer coverage for the Mid-Atlantic purse seine fishery.                                 | 6       | High        |
| Northeast  | Mid-Atlantic Shrimp Fishery             | Implement pilot observer coverage for the Mid-Atlantic shrimp trawl fishery.                                | 19      | High        |
| Northeast  | New England Crab Pots                   | Implement pilot observer coverage for the New England crab pot fishery.                                     | 25      | High        |
| Northeast  | New England Clam/Quahog Dredge Fishery  | Implement pilot observer coverage for the New England clam/quahog dredge fishery.                           | 12      | High        |
| Northeast  | New England Fish Pots/Traps             | Implement pilot observer coverage for the New England fish pot/trap fishery.                                | 12      | High        |
| Northeast  | New England Lobster Pots                | Implement pilot observer coverage for the New England lobster pot fishery.                                  | 110     | High        |
| Northeast  | New England Scottish Seine Fishery      | Implement pilot observer coverage for the New England Scottish seine fishery.                               | 23      | High        |
| Northeast  | Mid-Atlantic Scallop Dredge Fisheries   | Implement observer program coverage for general category vessels operating in open areas.                   | Unknown | High        |
| Northeast  | Mid-Atlantic Scallop Trawl Fisheries    | Implement pilot observer coverage for the Mid-Atlantic limited-access scallop trawl fishery.                | 24      | High        |

# U.S. NATIONAL BYCATCH REPORT

**Appendix Table 5.A** (continued)

| REGION   | FISHERY  | RECOMMENDATION   | DAS     | FEASIBILITY |
|--|--|--|---------|-------------|
| <b>Observer Coverage<br/>Implement New Observer Programs (cont.)</b>   |  |  |         |             |
| Northeast  | Mid-Atlantic Scallop Trawl Fisheries                   | Implement observer program coverage for general category vessels operating in open areas.  | Unknown | High        |
| TOTAL NORTHEAST TO IMPLEMENT NEW OBSERVER PROGRAMS   |  |  | 615     |             |
| Southeast  | South Atlantic Snapper–Grouper Bottom Longline Fishery | Develop a pilot observer program, including determination of needed sample size to achieve 30% uncertainty <sup>a</sup> for the ten most commonly discarded species, for the South Atlantic snapper–grouper bottom longline fishery. | 1,600   | High        |
| Southeast  | South Atlantic Snapper–Grouper Handline Fishery        | Develop a pilot observer program, including determination of needed sample size to achieve 30% uncertainty <sup>a</sup> for the ten most commonly discarded species, for the South Atlantic snapper–grouper handline fishery.        | 1,600   | High        |
| Southeast  | South Atlantic and Gulf of Mexico Reef Fish Fishery    | Develop pilot programs to test the use of electronic video monitoring on reef fish vessels in the Gulf of Mexico and South Atlantic to augment data collected by observers. Pilot project on six vessels for 2 months.               | 120     | Low         |
| Southeast  | Gulf of Mexico Coastal Pelagic Troll Fishery           | Develop a pilot observer program, including determination of needed sample size to achieve 30% uncertainty <sup>a</sup> for the ten most commonly discarded species, for the Gulf of Mexico coastal pelagic troll fishery.           | 1,600   | Moderate    |
| Southeast  | South Atlantic Coastal Migratory Pelagic Troll Fishery | Develop a pilot observer program, including determination of needed sample size to achieve 30% uncertainty <sup>a</sup> for the ten most commonly discarded species, for the South Atlantic coastal migratory pelagic troll fishery. | 416     | Moderate    |
| Southeast  | Gulf of Mexico Shrimp Trawl Fishery                    | Develop remote observer program (underwater video, etc.) for Gulf of Mexico shrimp trawl fishery to document takes.  | 416     | High        |
| TOTAL SOUTHEAST TO IMPLEMENT NEW OBSERVER PROGRAMS   |  |  | 5,752   |             |
| Northwest  | West Coast Mid-Water Trawl Hake Fishery                | Test and deploy electronic monitoring systems aboard the entire West Coast mid-water trawl hake fishery for at-sea catcher vessels.  | 225     | High        |
| Northwest  | West Coast Non-Tribal Ocean Salmon Troll Fishery       | Restore and expand state and tribal observer programs for the West Coast non-tribal ocean salmon troll fishery.  | 750     | Moderate    |
| Northwest  | West Coast Tribal Ocean Troll Fishery                  | Restore and expand state and tribal observer programs for the West Coast tribal ocean troll fishery.   | 83      | Moderate    |
| TOTAL NORTHWEST TO IMPLEMENT NEW OBSERVER PROGRAMS   |  |  | 1058    |             |
| Southwest  | California Swordfish Harpoon Fishery                   | Implement a pilot observer program for the California swordfish harpoon fishery at 10% observer coverage.  | 20      | High        |
| TOTAL SOUTHWEST TO IMPLEMENT NEW OBSERVER PROGRAMS   |  |  | 20      |             |
| NATIONAL TOTAL TO IMPLEMENT NEW OBSERVER PROGRAMS <sup>d</sup>   |  |  | 7,425   |             |
| NATIONAL TOTAL OBSERVER COVERAGE COST (MAINTAIN AND EXPAND EXISTING PROGRAMS, AND IMPLEMENT NEW PROGRAMS) <sup>d</sup> |  |  | 137,591 |             |

# NATIONAL OVERVIEW

**Appendix Table 5.A** (continued)

| REGION                     | FISHERY  | RECOMMENDATION  | DAS     | FEASIBILITY                     |
|----------------------------|--|---|---------|---------------------------------|
| <b>Supplemental Data</b>   |  |   |         |                                 |
| Northeast                  | All fisheries  | Improve industry data via expanded audits (fish and PR).  | NA      | High                            |
| Northeast                  | Mid-Atlantic Gillnet Fisheries   | Expand number of fishing effort variables collected by states.  | NA      | Low                             |
| Northeast                  | Mid-Atlantic Otter Trawl Fisheries                                     | Update vessel trip report logbooks to include a field for BRD presence/absence, and whether BRD was functioning properly.   | NA      | Unknown                         |
| Northeast                  | Mid-Atlantic Scallop Trawl Fisheries                                   | Improve vessel trip report gear log to capture additional gear information.   | NA      | Unknown                         |
| Southeast                  | Multiple Fisheries   | Change logbook system to define target by set for multiple fisheries.   | NA      | Low                             |
| Southeast                  | Gulf of Mexico Shrimp Trawl Fishery                                    | Revise logbook and trip ticket programs for Gulf of Mexico shrimp trawl fishery to better estimate effort.  | NA      | Low                             |
| Southeast                  | Large Coastal and Small Coastal Shark Aggregate                        | Relate large coastal and small coastal shark aggregate (drift, strike, and bottom gillnet) fishery observer and logbook databases.  | NA      | High; currently being worked on |
| Southeast                  | Southeastern Atlantic and Gulf of Mexico Shark Bottom Longline Fishery | Correlate Southeastern Atlantic and Gulf of Mexico shark bottom longline fishery observer and logbook databases.  | NA      | High; currently being worked on |
| Northwest                  | California/Oregon Nearshore Rockfish Fishery                           | Explore additional sources of data for improving estimation methods in the California/Oregon nearshore rockfish fishery.  | NA      | High                            |
| <b>Analytical Approach</b> |  |   |         |                                 |
| Northeast                  | Multiple Fisheries   | Improve analytic approach via advances in the methods of estimators.  | NA      | High                            |
| Northeast                  | Mid-Atlantic Scallop Dredge Fisheries                                  | Hire employee to process vessel monitoring system data for use in bycatch estimation in Mid-Atlantic limited-access open-area scallop dredge fishery (protected species). | NA      | Unknown                         |
| Northeast                  | Mid-Atlantic Scallop Dredge Fisheries                                  | Investigate effectiveness of analyzing the sea turtle bycatch rate by pooling data over year (protected species).   | NA      | High                            |
| Northeast                  | Mid-Atlantic Scallop Trawl Fisheries                                   | Hire employee to process vessel monitoring system data for use in bycatch estimation.   | NA      | Unknown                         |
| Northeast                  | New England Gillnet Fisheries  | Apply new regression methods to estimate bycatch of marine mammals in New England gillnet fisheries (protected species).  | NA      | High                            |
| Alaska                     | Multiple Fisheries   | Catch Accounting System (CAS) improvements (one-time cost).   | Unknown | High                            |
| Alaska                     | Multiple Fisheries   | Improve seabird monitoring and bycatch estimation (one-time cost).  | Unknown | High                            |
| Northwest                  | Multiple Fisheries   | Fund additional data analyst time to improve estimation methods for West Coast Groundfish Observer Program.   | NA      | High                            |

# U.S. NATIONAL BYCATCH REPORT

| REGION  | FISHERY   | RECOMMENDATION   | DAS    | FEASIBILITY |
|---|---|--|--------|-------------|
| <b>Analytical Approach (cont.)</b>                                      |   |  |        |             |
| Southwest   | Multiple Fisheries                              | Hire finfish bycatch analyst to generate annual bycatch estimates for multiple fisheries   | NA     | High        |
| Southwest   | California Pelagic Longline Fisheries           | Aggregate bycatch of the California pelagic longline fishery with longline fisheries operating out of Hawaii to avoid data confidentiality issues. | NA     | High        |
| Pacific Islands   | Hawaii Deep- and Shallow-Set Longline Fisheries | Develop and maintain statistical estimator for discarded fish weight in the Hawaii deep- and shallow-set longline fisheries.                       | NA     | High        |
| Pacific Islands   | Hawaii Deep- and Shallow-Set Longline Fisheries | Develop and maintain statistical estimator for discarded fish weight in the American Samoa Longline fishery.                                       | NA     | High        |
| DAS REQUIREMENTS TO BE MAINTAINED <sup>b,c</sup>                        |   |  | 70,957 |             |
| TOTAL ADDITIONAL DAS NEED TO MEET REPORT RECOMMENDATIONS <sup>c,d</sup> |   |  | 66,634 |             |

<sup>a</sup> Coefficient of variation (CV).

<sup>b</sup> Estimations of requirements to maintain current observer coverage are based on FY 2008 data.

<sup>c</sup> Estimates include DAS that are industry funded.

<sup>d</sup> Does not include unknowns or staff time.